User's Manual

FN310
Field Wireless
Multi-Protocol Module
(RS485 Modbus Protocol)

IM 01W03D02-01EN

YOKOGAWA
Yokogawa Electric Corporation

IM 01W03D02-01EN
1st Edition

FN310
Field Wireless Multi-Protocol Module
(RS485 Modbus Protocol)

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1. Introduction

This manual describes how to use the FN310 Field Wireless Multi-Protocol Module (hereafter simply referred to as FN310).

FN310 was precisely calibrated at the factory before shipment. To ensure both safety and efficiency, please read this manual carefully before you operate this product.

FN310 works by utilizing the FN110 Field Wireless Communication Module (hereafter simply referred to as FN110). Please attach FN110 before use.

Table1.1 summarizes the related document list of this manual.

Table 1.1 Related Document List

Title	Document No.
FieldMate Versatile Device Management Wizard User's Manual	IM 01R01A01-01E
YFGW710 Field Wireless Integrated Gateway User's Manual	IM 01W01F01-01EN
YFGW410 Field Wireless Management Station User's Manual	IM 01W02D01-01EN
FN110 Field Wireless Communication Module General Specifications	GS 01W03B01-01EN
SENCOM FU20F Digital pH/ORP-sensor General Specifications	GS 12B6J3-04E-E

■ Regarding This Manual

- This manual should be provided to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made products.
- Please note that changes in the specifications, construction, or component parts of this product may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.
- The following safety symbols are used in this manual:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or physical damage. It may also be used to alert against unsafe practices.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

1.1 Safe Use of This Product

For the safety of the operator and to protect this product and the system, please be sure to follow this manual's safety instructions when handling this product. If these instructions are not heeded, the protection provided by this product may be impaired. In this case, Yokogawa cannot guarantee that this product can be safely operated. Please pay special attention to the following points:

(a) Installation

- This product may only be installed by an engineer or technician who has an expert knowledge of this product. Operators are not allowed to carry out installation unless they meet this condition.
- With high process temperatures, care must be taken not to burn yourself by touching this product or its casing.
- All installation shall comply with local installation requirements and the local electrical code.

(b) Wiring

- This product must be installed by an engineer or technician who has an expert knowledge of this product. Operators are not permitted to carry out wiring unless they meet this condition.

(c) Maintenance

- Please carry out only the maintenance procedures described in this manual. If you require further assistance, please contact the nearest Yokogawa office.
- Care should be taken to prevent the build up of dust or other materials on the display glass and the nameplate. To clean these surfaces, use a soft, dry cloth.

(d) Modification

- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this product by the customer.

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurring during the warranty period shall basically be repaired free of change.
- If any problems are experienced with this product, the customer should contact the Yokogawa representative from which this product was purchased or the nearest Yokogawa office.
- If a problem arises with this product, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- The party responsible for the cost of fixing the problem shall be determined by Yokogawa following an investigation conducted by Yokogawa.

■ **The purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:**

- Improper and/or inadequate maintenance by the purchaser.
- Malfunction or damage due to a failure to handle, use, or store this product in accordance with the design specifications.
- Use of the product in question in a location not conforming to the standards specified by Yokogawa, or due to improper maintenance of the installation location.
- Failure or damage due to modification or repair by any party except Yokogawa or an approved representative of Yokogawa.
- Malfunction or damage from improper relocation of the product in question after delivery.
- Reason of force majeure such as fires, earthquakes, storms/floods, thunder/ lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

■ **Trademarks**

In this document, trademarks or registered trademarks are not marked with "™" or "®". Product names and company names in this document are trademarks or registered trademarks of the respective companies.

■ **Authorized Representative in the EEA**

The Authorized Representative for this product in the EEA is: Yokogawa Europe B.V.

Euroweg 2, 3825 HD Amersfoort, THE NETHERLANDS.

2. Notes on Handling

The FN310 is fully factory-tested before shipment. When the FN310 delivered, check the appearance for damage, and also check that the mounting parts shown in Figure 2.1 are included with your shipment. If “No Mounting Bracket” or “Horizontal connection” is indicated, no mounting bracket is included.

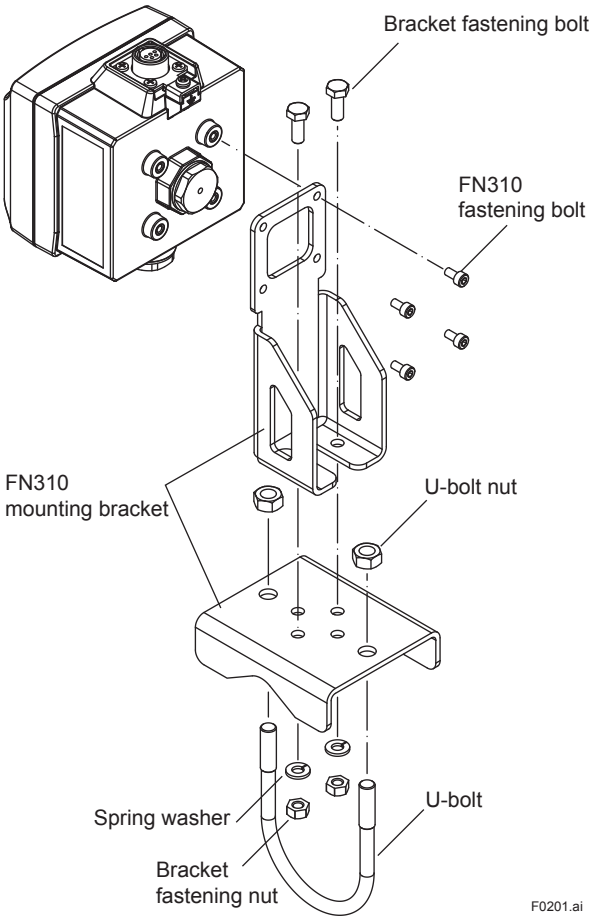


Figure 2.1 FN310 Mounting Hardware

Table 2.1 FN310 Mounting Hardware

Part name	Quantity
FN310 mounting bracket	1
FN310 fastening bolt	4
Bracket fastening bolt	2
Bracket fastening nut	2
Spring washer	2
U-bolt	1
U-bolt nut	2

■ Bundled items

- User’s Manual (IM 01W03D02-01EN)
- FN310 mounting hardware
  When specified mounting bracket.
- Protection cap (optional specifications)
- Wired tag plate (optional specifications)

2.1 Check the Model Name and Configuration

The model name and configuration are indicated on the nameplate. Verify that the configuration indicated in the “Model and Suffix Code” in subsection 10.2 is in compliance with the specifications written on the order sheet. Manual number omitting the language code at the end is printed on the nameplate.

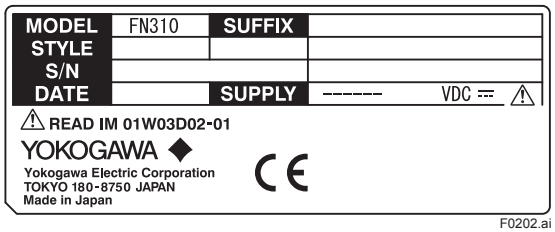


Figure 2.2 Nameplate

2.2 Transport

To prevent damage while in transit, leave the FN310 in the original shipping container until it reaches the installation site. For transportation of batteries, refer to subsection 8.5 “Handling Batteries”.

2.3 Storage

When storing this product, observe the following precautions.

1. Chose a storage location that satisfies the following requirements.
   - A location that is not exposed to rain or water.
   - A location subject to a minimum of vibration or impact.
   - The following temperature and humidity range is recommended. Ordinary temperature and humidity (25°C, 65%) are preferable.
     Temperature: -40 to 85°C
     Humidity : 0 to 100% RH
     (no condensation)
2. If at all possible, store the FN310 in factory-shipped condition, that is, in the original shipping container.
3. Preferably remove the batteries for storage. For maximum battery life, the storage temperature should not exceed 30°C.

NOTE

When storing FN310 with a battery pack, it is recommended to put the FN310 in Deep Sleep mode to conserve the batteries. For details on how to switch to Deep Sleep mode, refer to subsection 7.3.9 “Switching to the Deep Sleep Mode”.

2.4 Selecting the Installation Location

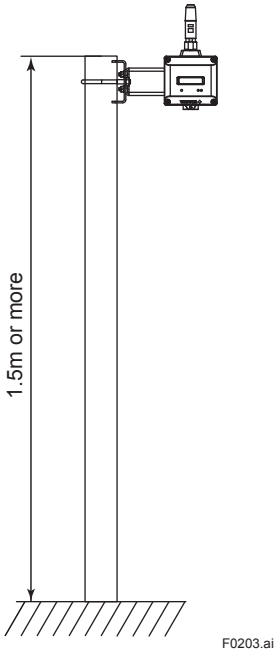
Although this product is designed to operate in a harsh environment, to maintain stability and accuracy, the following is recommended.

■ Wireless Communication

NOTE

The installation location of this product must meet the following conditions:

- Install this product to be perpendicular to the ground.
- When using a remote antenna cable, regardless of the installing direction of the FN310, install the FN110 to be perpendicular to the ground.
- Install the FN110 at least 1.5 m above the ground or floor.



- Ensure that there are no obstacles such as walls or pipes within a 30 cm radius of the FN110.
- Confirm that each field wireless equipment can see the antenna of other devices which locate within its own communication range.

■ Ambient Temperature

It is preferable to not to expose the instrument to extreme temperatures or temperature fluctuations. If FN310 is exposed to radiation heat a thermal protection system or appropriate ventilation is recommended.

■ Environmental Requirements

Do not allow FN310 to be installed in a location that is exposed to corrosive atmospheric conditions. When using this product in a corrosive environment, ensure the location is well ventilated.
The unit and its wiring should be protected from exposure to rainwater.

■ Impact and Vibration

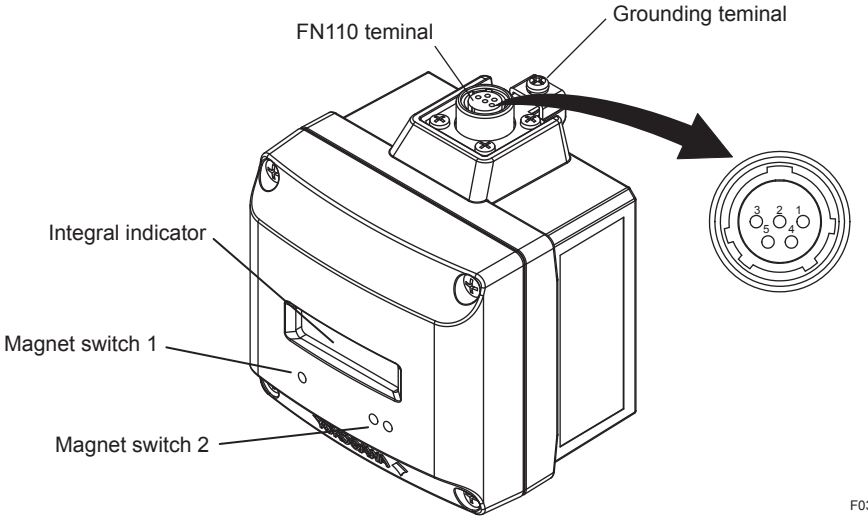
It is recommended that the FN310 be installed in a location that is subject to a minimum amount of impact and vibration.

2.5 Use of a Transceiver

IMPORTANT

Although FN310 has been designed to resist high frequency electrical noise, if a radio transceiver is used near the FN310 or its external wiring, the FN310 may be affected by high frequency noise pickup. To test this, start out from a distance of several meters and slowly approach the FN310 with the transceiver while observing the measurement loop for noise effects. Thereafter use the transceiver outside the range where the noise effects were first observed.

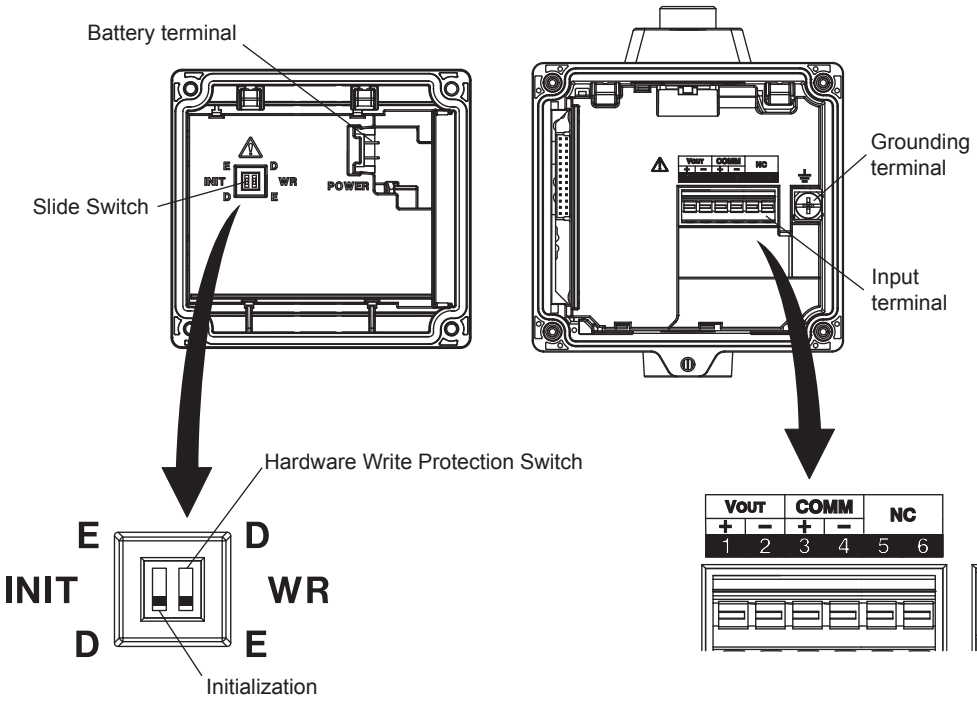
3. Component Names



F0301.ai

Pin	Signal
1	Frame Ground *
2	Signal Ground
3	Power Supply
4	Transmit/Receive Data positive
5	Transmit/Receive Data negative

* Wired to the grounding terminal inside the FN310 housing.



F0302.ai

Hardware Write Protection Switch (WR)		
Write Protection Switch Position *1	E D INIT WR D E F0303.ai	E D INIT WR D E F0304.ai
Write Protection	No (Write enabled)	Yes *2 (Write disabled)

*1: Initialization switch is not used. Set to D side (disabled) always.
*2: When the switch is D side (write protection setting), provisioning is acceptable. For details of provisioning, refer to subsection 6.3 “Connecting to the Field Wireless Network”.

Terminal	Signal
1	Power Supply +
2	Power Supply Gnd
3	Data +
4	Data -
5	No Connection
6	No Connection
⏚	Frame Ground

4. Installation

4.1 Precautions

- Before installing FN310, read the cautionary notes in subsection 2.4 “Selecting the Installation Location”.
- For additional information on the ambient conditions allowed at the installation location, refer to subsection 10.1 “Standard Specifications”.

IMPORTANT

Connector Protection

The FN110 terminal is covered with a cap during shipping. Keep the cap attached until connecting the FN110 or remote antenna cable to protect the inside connection part. The unscrewed cap should be stored in order to replace it immediately after the FN110 or remote antenna cable is removed. If there is a possibility that get wet with water, order FN310 with optional specification for a protection cap.

Installation Work

- When performing on-site pipe fitting work that involves welding, use case to prevent the welding current to damage the FN310.
- Do not use the FN310 as a foothold.

NOTE

- Before using FN310, install FN110. For detail on how to install FN110, refer to subsection 4.2.1 “Installation of FN110”.
- To connect FN310 to the field wireless network, information for connecting to the field wireless devices needs to be set beforehand. Refer to subsection 6.3 “Connecting to the Field Wireless Network”.

4.2 Mounting

This product is installed on a 50A (2-inch) pipe.

■ Mounting on a 50A (2-inch) pipe

FN310 is installed on a 50A (2-inch) pipe with mounting bracket. It supports both of a horizontal pipe and a vertical pipe. Refer to subsection 4.2.2 “Mounting on a 50A (2-inch) Pipe” for details. For detail on how to install FN110, refer to subsection 4.2.1 “Installation of FN110”. For using remote antenna cable, refer to subsection 5.3 “Installation and Connection of FN110”.

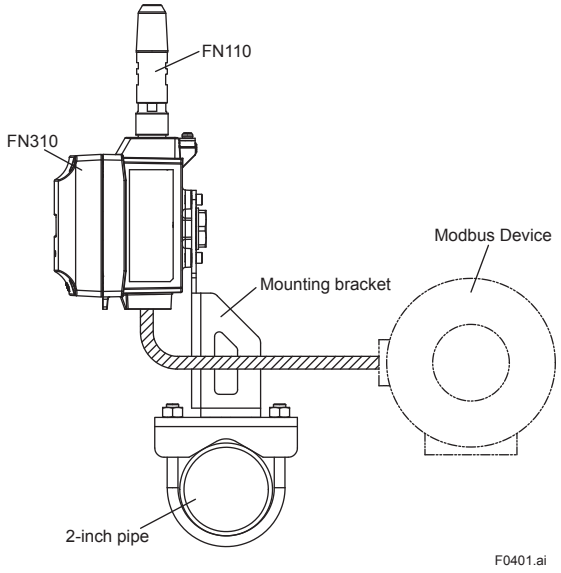


Figure 4.1 Direct Mounting of FN110

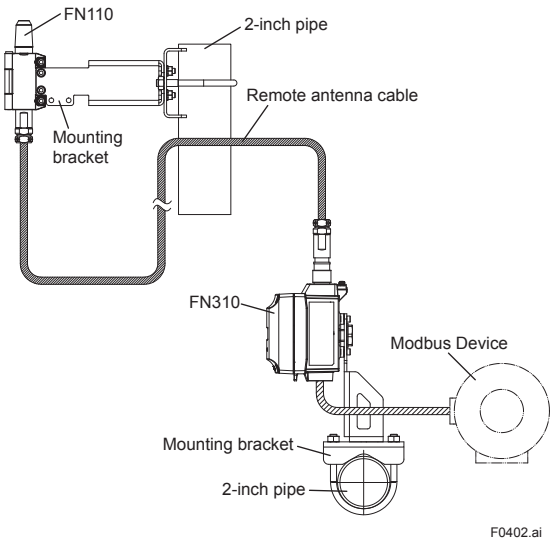


Figure 4.2 Using Remote Antenna Cable

4.2.1 Installation of FN110

Install FN110 to the FN110 terminal of FN310. Before installation, remove the unscrewed cap attached to the connector and remove the battery pack from FN310.

The installation procedure is as follows.

1. Check the direction of the pin, connect FN110 to FN310.
2. Tighten the lock nut to torque of 1.2 N•m. Removal is the reverse procedure of the installation.

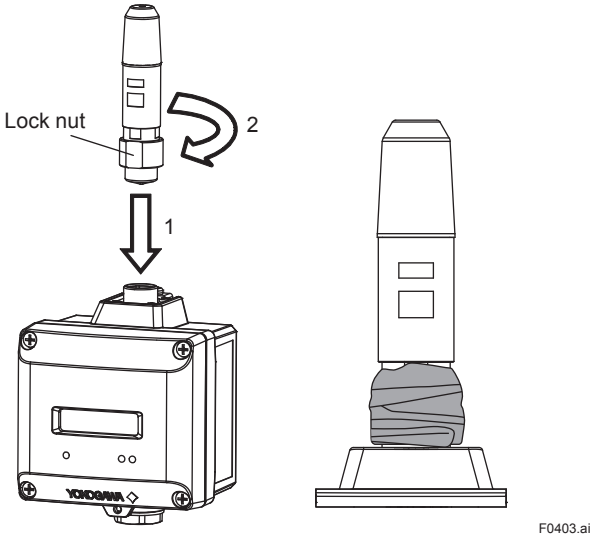


Figure 4.3 Installation of FN110 and Sealing of the Connector

CAUTION

- To maintain a good connection between the modules, protect the connector from the corrosive atmosphere by the following treatment.
  1. Clean the connection to be protected.
  2. Wind the butyl rubber self-bonding tape around the connection. See the manual of the tape about the winding.
  3. To protect the butyl rubber self-bonding tape from the environment such as ultraviolet rays and so on, wind vinyl tape (or a vinyl type self-bonding tape) on it.
  4. When the tape is necessary, prepare appropriate tape for the installing environment.

  Do not cover the nameplate by the tapes.
- When a remote antenna cable is used for installing FN110, refer to subsection 5.3 “Installation and Connection of FN110”.
- Remove the battery pack before installing FN110. Refer to subsection 8.3 “Replacing the Battery Pack” for the battery pack removing.
- When installing FN110, fix the FN110 by tightening the lock nut. Screwing by holding the FN110 housing may cause failure such as cable disconnection. The same manner should be taken when removing the FN110.

4.2.2 Mounting on a 50A (2-inch) Pipe

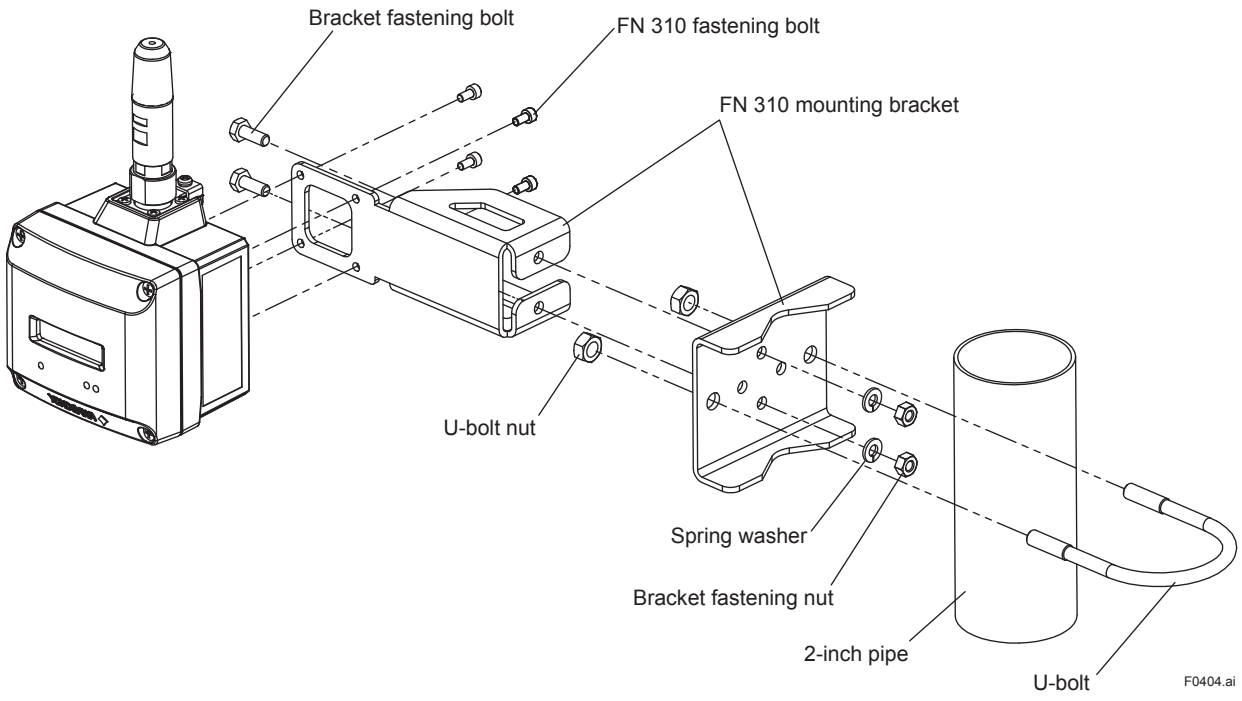


Figure 4.4 Vertical Pipe Mounting

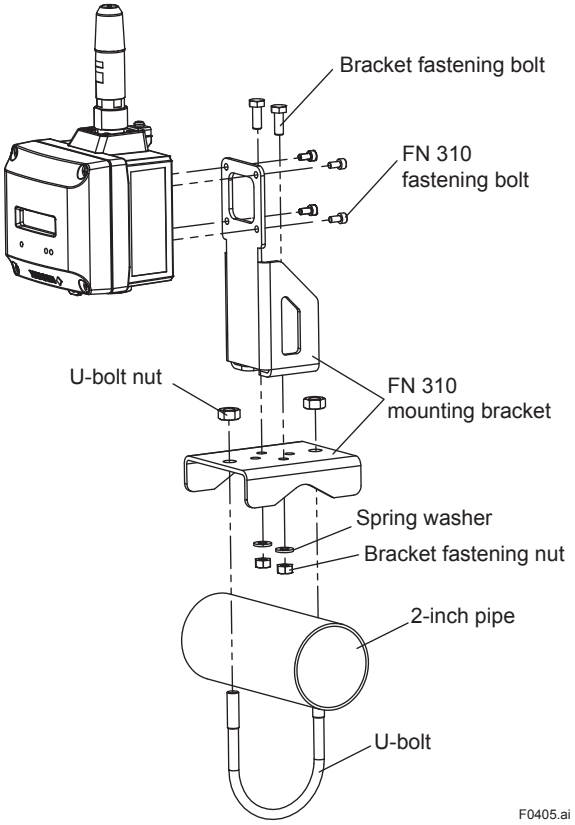


Figure 4.5 Horizontal Pipe Mounting

■ **To install FN310 on a 50A (2-inch) pipe, follow the procedure below.**

1. Assemble the FN310 mounting bracket.
2. Install FN310 to the mounting bracket using provided bolt (4) with a torque 1.4 N•m.
3. Install FN310 mounting bracket to the 2-inch pipe by U-bolt.

5. Wiring

5.1 Notes on Wiring

IMPORTANT

- Apply a waterproofing sealant to the threads of the connection port. (It is recommended that you use non-hardening sealant made of silicon resin for waterproofing.)
- Lay wiring as far away as possible from electrical noise sources such as large transformers, motors and power supplies.
- Remove the wiring connection dust-caps before wiring.
- To prevent electrical noise, the signal cable and the power cable must not be housed in the same conduit.

NOTE

- When wiring where the ambient temperature is high or low, use the cable or wire that appropriate to that place.
- When the maximum operating temperature is more than 60°C, use the cable of 85°C or higher temperature rating.

5.2 Cable Selection

For wiring the Modbus device and the FN310, use a shielded multi-core cable of AWG24 to 14.

■ Applicable Cables

Cables for industrial equipment such as;

- Control cables: JIS C 3401

When using SECOM FU20F-NPT, refer to subsection 9.1.1 “Cable Selection”.

Use the following grounding cable.

■ Applicable Cables

Insulated cables for industrial equipment such as;

- 600V polyvinyl chloride insulated wires (IV): JIS C3307
- Polyvinyl chloride insulated wires for electrical apparatus (KIV): JIS C3316
- 600V grade heat-resistant polyvinyl chloride insulated wires (HIV): JIS C3317
- Heartproof vinyl insulated wires VW-1 (UL 1015/UL 1007)

Wire size

- Core: AWG14 to 13 (2 mm^2 to 2.6 mm^2)

Termination

- Use a ring tongue terminal for M4 terminals: with an insulation sleeve

5.3 Installation and Connection of FN110

IMPORTANT

The FN110 connection terminal is covered with a cap at the time of deliverty. Keep the cap attached until connecting the FN110 or remote antenna cable to protect the inside connection part. The unscrewed cap should be stored in order to replace it immediately after the FN110 or remote antenna cable is removed. If there is a possibility that get wet with water, order FN310 with optional specification for a protection cap.

5.3.1 Installation of FN110

■ Location of FN110

Mount the FN110 at the proper location according to the wireless environment described in subsection 2.4 “Selecting the Installation Location”. The mounting to the pipe such as 50A (2-inch) pipe needs to secure the enough strength to endure a strong wind, vibration and so on. The FN110 must be mounted vertically.

■ Fixing of FN110

Fix the FN110 on a 50A (2-inch) pipe with the mounting bracket provided as the remote antenna cable option.

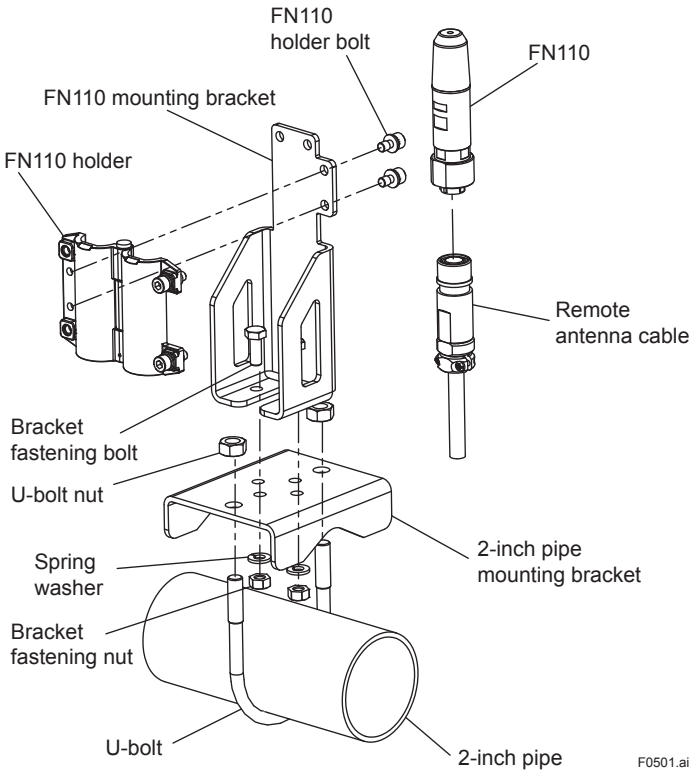


Figure 5.1 Horizontal Pipe Mounting of FN110

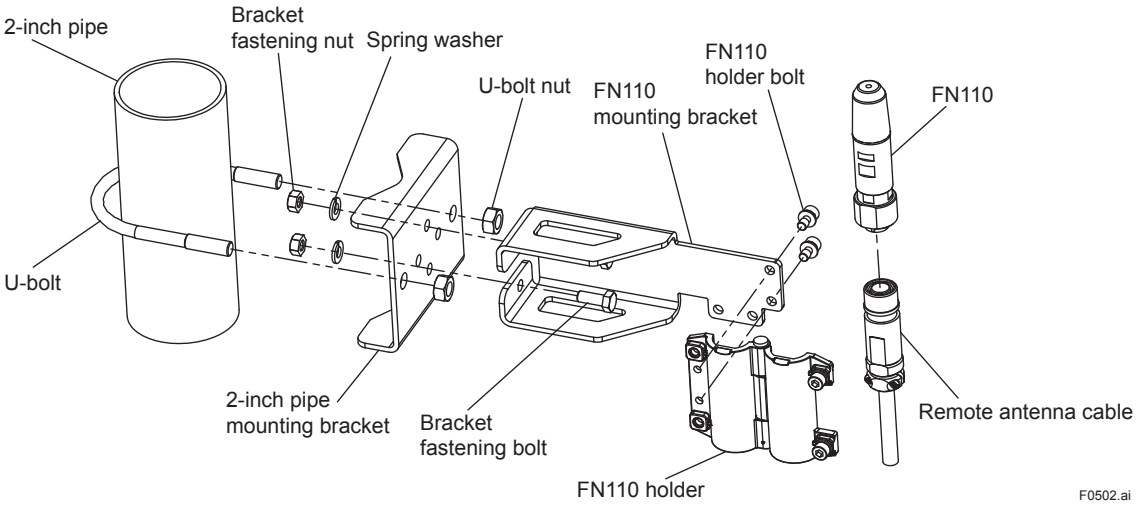


Figure 5.2 Vertical Pipe Mounting of FN110

■ To install FN110 with mounting bracket, follow the procedure below.

1. Assemble the mounting bracket and fix it on a 50A (2-inch) pipe.
2. Connect the remote antenna cable to the FN110.
3. Protect the connection as necessary. For details of the protection, refer to subsection 4.2.1 “Installation of FN110”.
4. Fix the FN110 to the mounting bracket.

5.3.2 Connection of FN110

■ **To install FN110 with remote antenna cable, follow the procedure below.**

Remove the battery pack from FN310 before connecting the remote antenna cable.

1. Connect the FN110 and the FN310 with the dedicated remote antenna cable. Tighten the connector of the remote antenna cable with a torque of 1 to 1.2 N•m. The minimum bending radius should be more than 100 mm.
2. Protect the connectors of the FN110 and remote antenna cable as necessary. For details of the protection, refer to subsection 4.2.1 “Installation of FN110”.
3. Fix the remote antenna cable to an appropriate structure to protect the cable from the vibration, wind, and so on. The minimum bending radius for fixing in the state maintained for a long period should be more than 100 mm.

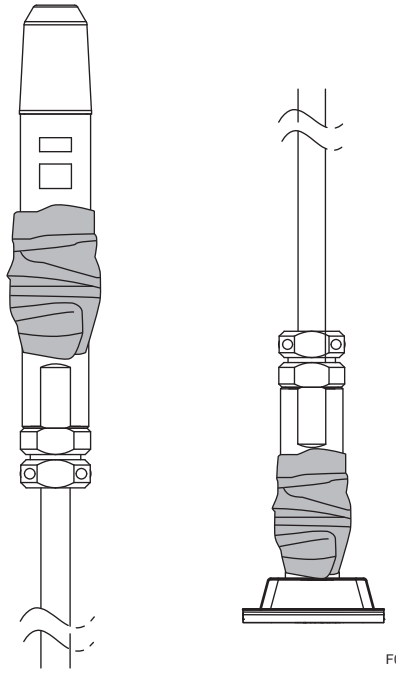


Figure 5.3 Sealing of the Remote Antenna Cable

CAUTION

- Use the dedicated remote antenna cable provided by Yokogawa as accessories for FN110.
- The remote antenna cable and other cables should not be bundled together.
- Remove the battery pack before installing FN110. Refer to subsection 8.3 “Replacing the Battery Pack” for the battery pack removing.

5.4 Connection of the Input Signal Cable

Refer to subsection 5.2 “Cable Selection” for the cable to be used.

How to connect each device refer to the corresponding item of section 9 “Connection Device Type”.

5.4.1 Connecting Input Terminal and Grounding Terminal

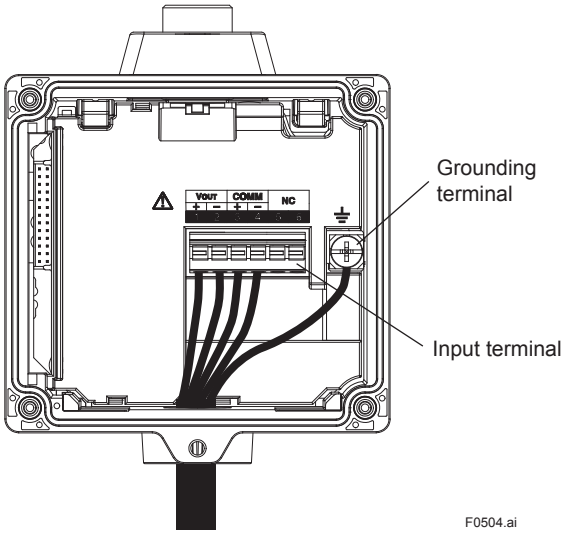


Figure 5.4 Wiring Example

The cable gland is not included. Prepare a cable gland with a flat gasket matching the electrical connection.
When M20 female is selected for vertical connection, tighten the cable gland with a torque of 2 N • m. When G 1/2 female or 1/2 NPT female is selected for vertical connection, fix the hexagonal shape part by tool and tighten the cable gland as shown in Figure 5.5.

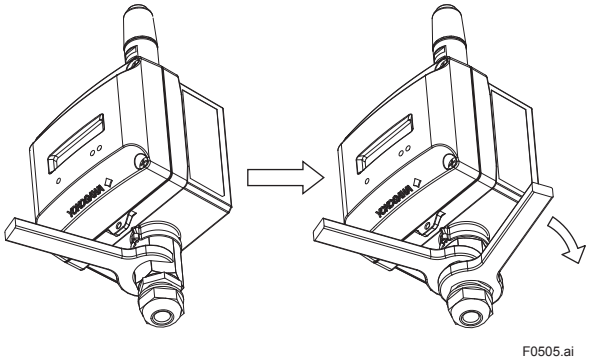


Figure 5.5 Tightening the Cable Gland

IMPORTANT

When using a cable gland, apply a water proofing sealant to the threads of the cable gland. (It is recommended that you use non-hardening sealant made of silicon resin for waterproofing.)

■ Input Terminal

Input terminal is a spring terminal. When using a solid conductor cable or with sleeve, connect the cable to the input terminal. When using a standard conductor, push down the top of a cable inlet and insert the cable. To unplug the cable, push down the top of a cable inlet and unplug the cable.

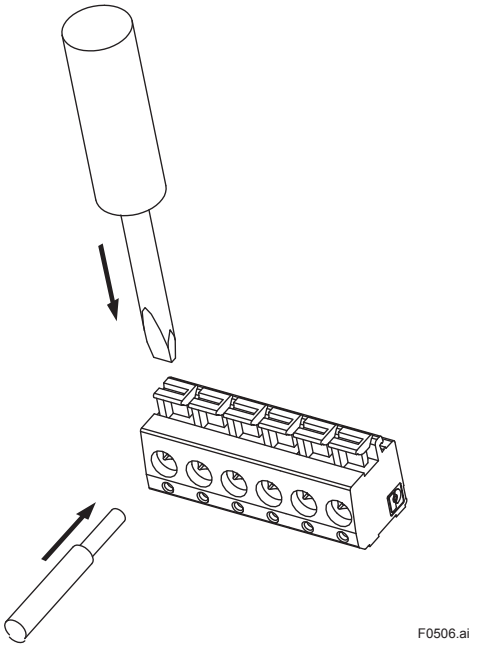


Figure 5.6 Connecting to the Input Terminal

■ Wiring to Input Terminals: 1 (with sleeve)

The sleeve can prevent cable leads from untwist when you connect the cable. Select a sleeve to match the cable size. If the length of cable leads does not match the length of sleeve (l_2), strip the cable to the correct length. Strip the cable for a length so that the core wire slightly extends from the metal tube of the sleeve. If this causes the length of the metal tube of the sleeve to be slightly shorter than the stripping length, this is no problem.
The wiring cables and applicable sleeves are listed in the table below. Use the same manufacturer for sleeves and tools.
Example of tool: Phoenix Contact's CRIMPFOX6
For details on sleeves and crimp tools, contact to Phoenix Contact Inc.

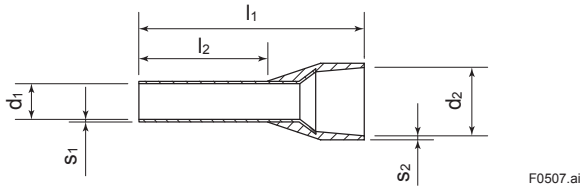


Figure 5.7 Sleeve Length

■ Wiring to Input Terminals: 2 (without sleeve)

- When using a solid conductor cable, strip the insulated cover and connect it. Strip the insulated cover for 8mm.
- When using a stranded conductor, strip the insulated cover and twist and connect it. Strip the insulated cover for 8mm. Never solder the stranded conductor when connecting cables. Be careful not to cause the loosely stranded conductor to come in contact with adjacent terminals or others. Insert the cable leads into the terminal block securely.

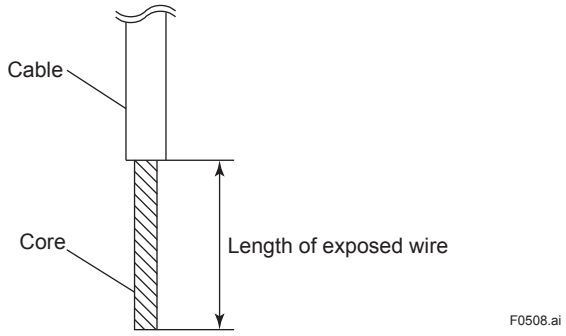


Figure 5.8 Length of Exposed Wire

Table 5.1 Corresponding Sleeve and Input Cables

Cable		Dimensions (mm)						Phoenix Contact's type
AWG	Strip length (mm)	l_1	l_2	d_1	S_1	d_2	S_2	
24	8	10.5	6	0.8	0.15	2	0.25	AI 0.25-6 BU
22	8	12.5	8	0.8	0.15	2	0.25	AI 0.34-8 TQ
20	8	14	8	1.1	0.15	2.5	0.25	AI 0.5-8 WH
18	8	14	8	1.3	0.15	2.8	0.25	AI 0.75-8 GY
18	8	14	8	1.5	0.15	3	0.3	AI 1-8 RD
16	8	14	8	1.8	0.15	3.4	0.3	AI 1.5-8 BK
14	8	14	8	2.3	0.15	4.2	0.3	AI 2.5-8 BU

CAUTION

Remove the battery pack before wiring. Refer to subsection 8.3 "Replacing the Battery Pack" for the battery pack removing.

■ Wiring to Ground Terminal

Protect the cable of the ground terminal by using heat-shrink tubing, etc. Use a ring tongue terminal for M4 terminals with an insulation sleeve.

5.5 Grounding

Class D grounding with the grounding resistance of 100Ω or less is necessary. To connect the grounding cable to FN310 directly, use the ground terminal on the top of the housing. Do not share the ground wiring with other devices.

■ Ground Wiring

Connect the grounding cable to ground terminal on the top of the housing.

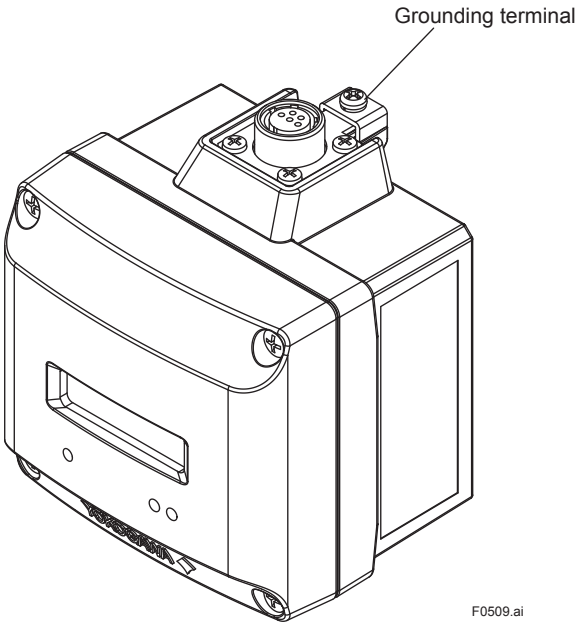


Figure 5.9 Grounding Terminal

CAUTION

Grounding is required for safe operation.

■ Input Cable Wiring

The input cable shield should be connected to grounding terminal inside of the housing.

- The input cable shield should not be connected to grounding terminal inside of the Modbus device.
- Connection to the ground terminal of Modbus device housing, refer to the User's Manual.

6. Operation

6.1 Preparation for Starting Operation

NOTE

- Before using FN310, connect FN110. For detail on how to install the FN110, refer to subsection 4.2.1 “Installation of FN110”.
- It is required to set security and network information to enable this product to be connected to the field wireless network. For more details, refer to subsection 6.3 “Connecting to the Field Wireless Network”.

(1) Setting the Modbus Device
Set the parameters of the Modbus device. For details about the settings, refer to Section 9 “Connection Device Type”. Refer to the user manual of the Modbus device for the setting method.

(2) Checking Installation and Wiring
Ensure that the FN310, FN110 and the Modbus device are installed correctly according to the procedures described in section 4 “Installation”, and section 5 “Wiring”.

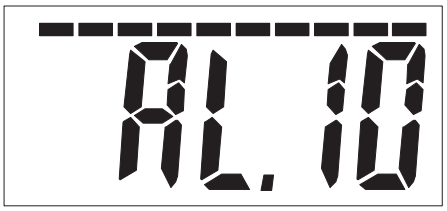
(3) Power On and Connecting to the Field Wireless Network
Insert batteries into the battery case, and install to the FN310. For details of installation of battery, refer to subsection 8.3 “Replacing the Battery Pack” and subsection 8.4 “Replacing the Batteries”. Provisioning is to set the security and network information. For details of provisioning, refer to section 6.3 “Connecting to the Field Wireless Network”.

(4) Checking parameter of the FN310 and the Modbus device
Use the device configuration tool and confirm that the Modbus device and the FN310 operate properly. Check parameter values or change the setpoints as necessary.
The integral indicator can be used to confirm that this product is operating properly. For details on how to confirm this, refer to subsection 7.4 “Self-Diagnostics”. ISA100 devices display self-diagnostic information in an easy-to-understand manner using four categories (Function check, Maintenance required, Failure, and Out of specification) according to NAMUR NE107*

*: NAMUR NE107 “Self-Monitoring and Diagnosis of Field Devices”

■ Confirm operation status by integral indicator

If the FN310 is faulty, an error code is displayed.



F0601.ai

Figure 6.1 Integral Indicator with Error Code

NOTE

If any of the above errors are indicated on the display of the integral indicator or the device configuration tool, refer to subsection 8.10.3 “Errors and Countermeasures” for the corrective action.

■ Verify and Change the FN310 Setting and Values

The followings are the required settings of the FN310. These parameters must be set before starting operation. Parameters to be set in advance depending on the connection device type. Refer to section 9 “Connection Device Type”.

• TRANSDUCER block: Sensor Type
Select the type of sensor to be connected to FN310. Select “Not Used” when using as a routing device without the Modbus device.

6.2 Starting Operation

Ensure that the installation, the wiring, the network connection, and the behavior of the FN310 are correct before starting operation.

IMPORTANT

Close the front panel. Tighten each screws to a torque of 0.7 N•m.

6.3 Connecting to the Field Wireless Network

■ Preparation Work Prior to Connecting to a Field Wireless Network

FN310 does not need to be connected with a physical wire. Instead of physical wiring, to set security and field network information is required. This procedure is called a provisioning.
FN310 supports provisioning via infrared communication using a provisioning device and can be securely connected to a network. If the provisioning information is not set, the FN310 cannot be connected to the field wireless network.

NOTE

Before provisioning, connect the FN110. For detail on how to install the FN110, refer to subsection 4.2.1 “Installation of FN110”.

For details on provisioning using a provisioning device, connecting to a field wireless network and the setting procedure, refer to the User’s Manual, FieldMate Versatile Device Management Wizard (IM 01R01A01-01E), YFGW710 Field Wireless Integrated Gateway (IM 01W01F01-01EN), and YFGW410 Field Wireless Management Station (IM 01W02D01-01EN).

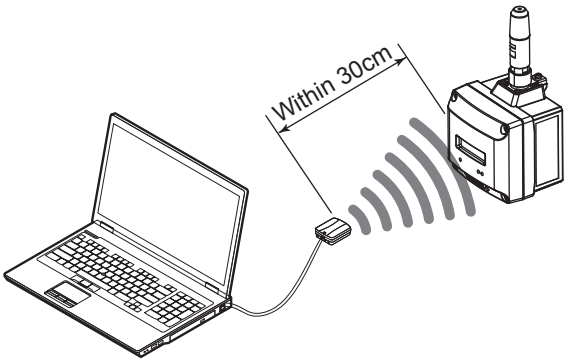


Figure 6.2 Provisioning Example

■ Provisioning Work

This subsection describes provisioning work using FieldMate as the provisioning device.
Provisioning work performs provisioning for each field wireless device using FieldMate and an infrared adapter.
When using the Yokogawa recommended near infrared adapter for the provisioning device, the distance between the front panel of this product and the infrared surface of the near infrared adapter should be within 30 cm. For details on the Yokogawa recommended infrared adapter, refer to subsection 8.2 “Recommended Products List”.
Perform the following provisioning tasks.

- Setting provisioning information
- Creating a provisioning information file

(1) Setting provisioning information

Set the device tag and Network ID using a FieldMate provisioning function. The device tag, Network ID, and join key are set in the field wireless device. It is not necessary to input a join key because FieldMate automatically generates it.

- Setting device tag
  The device tag is used for the user to recognize the field wireless device.
- Setting Network ID
  This is the Network ID for the field wireless network to which the field wireless device is connected. Set a value from 2 to 65535.

The field wireless device is connected to the field wireless network corresponding to the Network ID set by provisioning work.

(2) Creating a provisioning information file

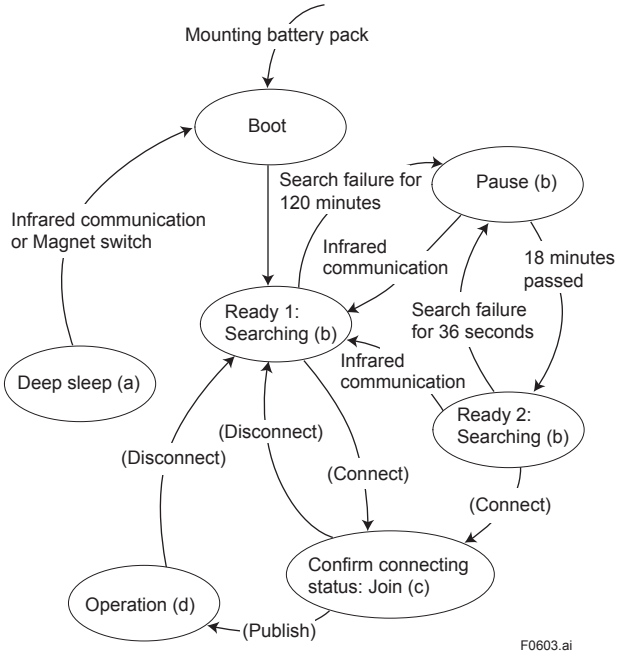
The following provisioned information is stored in the provisioning information file.

- Network ID
- Device tag
- EUI64
- Join key
- Provisioner (name of the user who performed provisioning work by Field Mate)
- Date (Time and date when provisioning was performed by FieldMate)

This provisioning information file is required to load from the field wireless configurator to the field wireless integrated gateway. Store the file carefully.

■ Connecting to a Field Wireless Network

The action after installing the battery pack varies depending on the silence setting.
Mounting the battery pack automatically starts a search for the field wireless network and the device goes into the join state when the field wireless gateway is found. If the field wireless gateway is not found and a specified time based on the silence mode has elapsed, a cycle of 18-minute pause and 36-second search is repeated until the device can join the field wireless network.
For details on the silence setting, refer to subsection 7.3.10 “Switching to the Silence Mode”.



* By using a magnet switch or filed device configuration tool, transitions to the Deep sleep state from any state.

Figure 6.3 Wireless Status Transition

(a) Deep Sleep

Figure 6.4 Display showing Deep Sleep State

Displays for 2 seconds in deep sleep setting, and then turns off.

(b) Ready and Pause

Figure 6.5 Display showing Ready and Pause State

(c) Confirm Connecting Status

Figure 6.6 Display showing Confirm Connecting Status State

(d) Join

Figure 6.7 Display showing Join State

NOTE

If the FN310 searches the field wireless network for long time low ambient temperature condition, sometimes error “AL.20 LOWBAT” is displayed on the integral indicator. It occurs because of battery characteristics even when using new batteries. After joining to the field wireless network, this error will be cleared within one hour if battery has no failure.

6.4 Display Contents of the Integral Indicator

■ Write Protect Status

When the write protection is enabled, the lock icon is displayed in the upper left corner of the integral indicator. For details on how to enable write protection, refer to subsection 7.3.8 “Write Protect”.

■ Wireless Communication Status

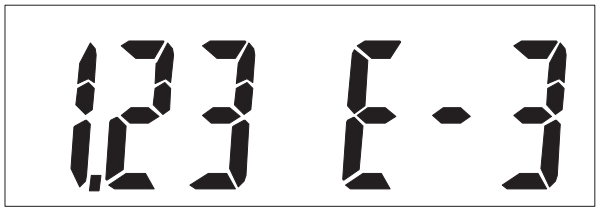
The status of wireless communication is indicated by the segments on the top of the integral indicator. Possible statuses are shown in Table 6.2.

Table 6.1 Wireless Communication Status List

Integral Indicator	Wireless Communication Status
No display	• RePause (Silence mode) • ReOperation (Published)
	• Ready • Joining
	• Confirm connecting status
	• Startup • Alert

■ Process Value

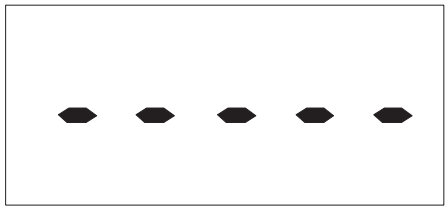
The process value obtained from the Modbus device is displayed. For detail information about the display settings, refer to section 7 “Setting Parameters”.
When sensor data is more than five orders of magnitude, scroll automatically after 2 seconds.



F0608.ai

Figure 6.8 Example of Data Scrolling

When publish is not configured or reading of process value from the Modbus device are not set, following is displayed.

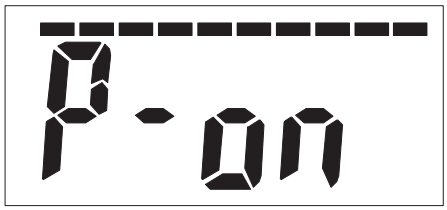


F0609.ai

Figure 6.9 Display when Publish is not Configured

■ Startup

When the FN310 powers on or recovers from the deep sleep mode, the following is displayed for 2 seconds.

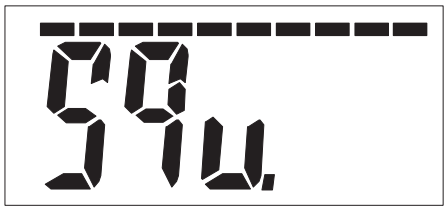


F0610.ai

Figure 6.10 Display after Power On

■ Setting the Find Device

When UAPMO.Find Device is set from FieldMate or PRM, following is displayed. The duration the display can be changed. For detail on how to display, refer to section 7 “Setting Parameters”.



F0611.ai

Figure 6.11 Display when Find Device is set

6.5 Shutting Down

When shut down the FN310, remove the battery pack or set the FN310 to deep sleep mode by the device configuration tool or magnet switch.

NOTE

- Refer to subsection 8.3 “Replacing the Battery Pack” for the battery pack removing.
- When storing the FN310 with a battery pack inserted, it is recommended to put the FN310 into deep sleep mode to conserve battery power. For details on how to switch to deep sleep mode, refer to subsection 7.3.9 “Switching to the Deep Sleep Mode”.

7. Setting Parameters

FN310 can remotely handle sensor type changes, Tag No. setup, monitoring of self-diagnostic results, according to communication with the field wireless configuration tool or the device configuration tool.

7.1 Preparation for Parameter Setting

This product can be set parameters via infrared port or field wireless network.
When setting parameters via field wireless network, connect this product to the field wireless network.
For details on how to connect to the field wireless network, refer to subsection 6.3 “Connecting to the Field Wireless Network”.
When setting parameters via infrared port, use the infrared port on front of this product.

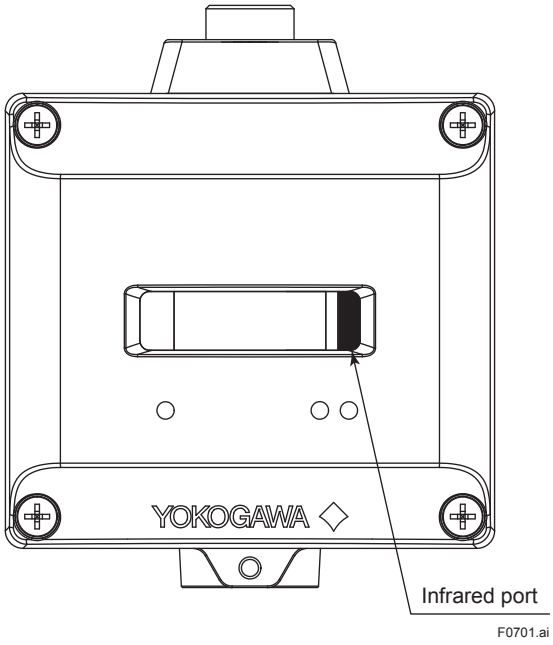


Figure 7.1 Connecting the Configuration Tool

7.2 Preparing Software

7.2.1 Softwares for the Field Wireless Configuration Tool and the Device Configuration Tool

Before using the device configuration tool, confirm that CF/DD and DeviceDTM for this product are installed in the device configuration tool.
Refer to the following website for the latest information on CF/DD and DeviceDTM.
<http://www.field-wireless.com/>

CF(Capabilities File)/DD(Device Description)

A CF file contains information, such as the vendor of the field device, its model and revision, available types of process data (flow rate, temperature, pressure, etc.), and number of data items. A DD file contains the information on parameters, such as data structures and attributes.

DeviceDTM

DeviceDTM, (Device Type Manager) is driver software for field devices provided based on the FDT (Field Device Tool) technology.

The field wireless configuration tool or the device configuration tool allows to read the device information.
Refer to subsection 8.2 “Recommended Products List” for the field wireless configuration tool or the device configuration tool of our recommendation.
Refer to the following website for the latest configuration tool and DeviceFile.
<http://www.field-wireless.com/>

7.2.2 Software Download

Software download function allows updating wireless field device software via ISA100.11a wireless communication. For details, refer to YFGW710 Field Wireless Integrated Gateway (IM 01W01F01-01EN) or YFGW410 Field Wireless Management Station (IM 01W02D01-01EN).

7.3 Setting Parameters

7.3.1 Parameter Usage and Selection

Before setting a parameter, please see the following table for a summary of how and when each parameter is used. FN310 supports a Modbus device connection and each value of Modbus device is assigned to AI1/AI2/AI3/AI4.

IMPORTANT

After setting and sending data with the field wireless configuration tool or the device configuration tool, wait 30 seconds before turning off the FN310. If it is turned off too soon, the setting will not be stored in the FN310.

7.3.2 Function Block and Menu Tree

(1) Function Block

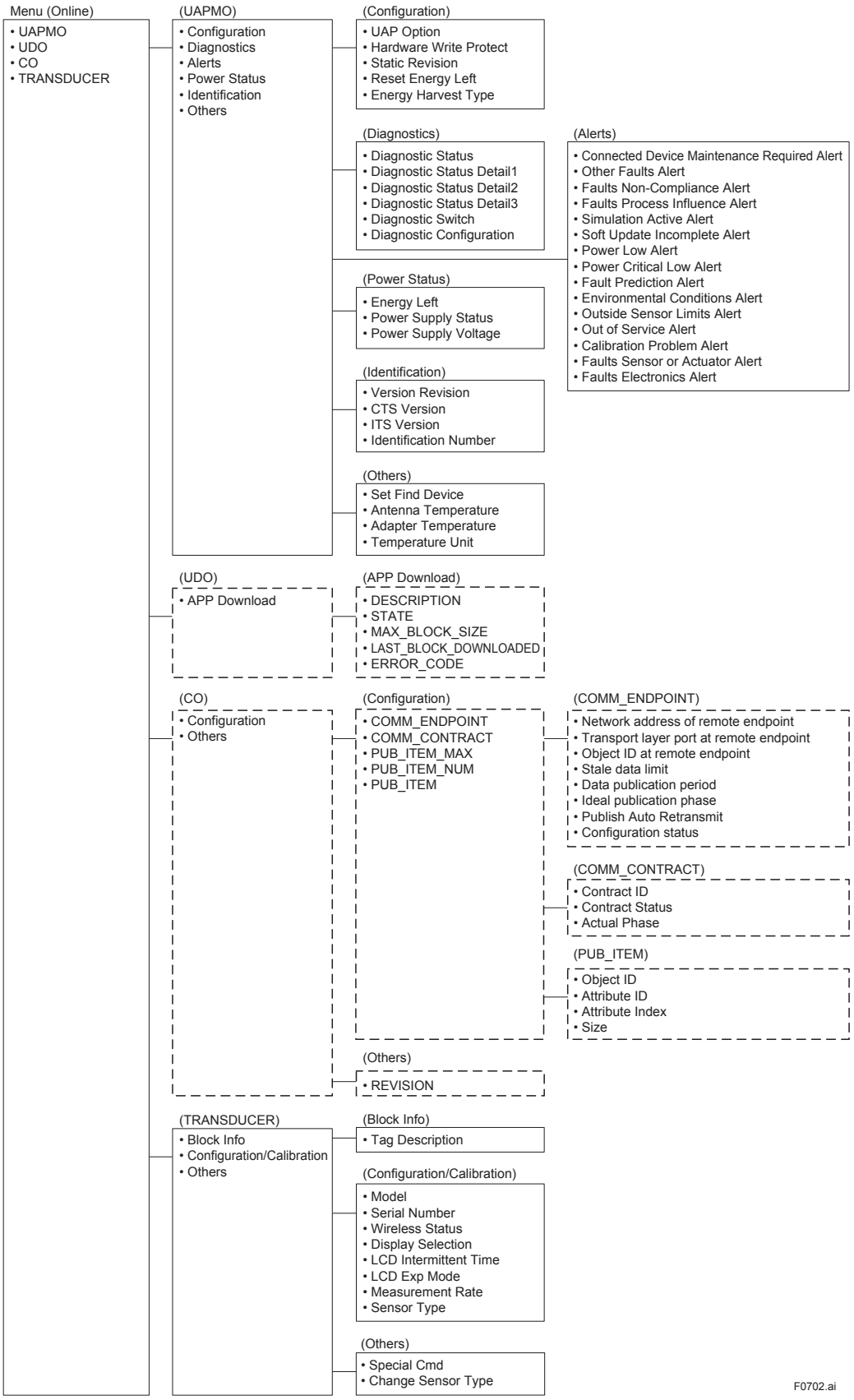
The function of FN310 is shown below. Some functions may not be available depending on the device configuration tool used. When the device configuration tool of our recommendation is used, the software attached to the Field Wireless Integrated Gateway or Field Wireless Management Station is necessary for setting the dotted line part. Refer to subsection 8.2 “Recommended Products List” for the field wireless configuration tool of our recommendation.
Function Block is depending on the connection device type. Refer to section 9 “Connection Device Type”.

Table 7.1 Parameter Usage and Selection

Item	Description
Tag No.	Sets the Tag No. for Device Tag (software tag). The Tag No. can be set sixteen characters (alphanumeric characters, including –).
Output mode	Allows outputting process value and self-diagnostic information via field wireless network. Either or all of sensor input (AI1/AI2/AI3/AI4 block: Process Value), and self-diagnostic information (UAPMO block: Diagnostic Status) can be set output data.
Modbus device setting	Sets the information about the Modbus device to be connected to the FN310.
Integral indicator display setting	Sets the process value to display on the LCD.
Software write protect	Prohibit writing the setting data.
Memo field	Memo field available to write the check date, checker and others (as an adjustment information), or anything.
Operational mode	Set the operational mode of the sensor and integral indicator, etc.

NOTE

Some of the parameter setting are in the dialogue form called method, by following the on-line instructions you can configure the parameters easily.


Menu (Online)
• UAPMO
• UDO
• CO
• TRANSDUCER
(UAPMO)
• Configuration
• Diagnostics
• Alerts
• Power Status
• Identification
• Others
(Configuration)
• UAP Option
• Hardware Write Protect
• Static Revision
• Reset Energy Left
• Energy Harvest Type
(Diagnostics)
• Diagnostic Status
• Diagnostic Status Detail1
• Diagnostic Status Detail2
• Diagnostic Status Detail3
• Diagnostic Switch
• Diagnostic Configuration
(Alerts)
• Connected Device Maintenance Required Alert
• Other Faults Alert
• Faults Non-Compliance Alert
• Faults Process Influence Alert
• Simulation Active Alert
• Soft Update Incomplete Alert
• Power Low Alert
• Power Critical Low Alert
• Fault Prediction Alert
• Environmental Conditions Alert
• Outside Sensor Limits Alert
• Out of Service Alert
• Calibration Problem Alert
• Faults Sensor or Actuator Alert
• Faults Electronics Alert
(Power Status)
• Energy Left
• Power Supply Status
• Power Supply Voltage
(Identification)
• Version Revision
• CTS Version
• ITS Version
• Identification Number
(Others)
• Set Find Device
• Antenna Temperature
• Adapter Temperature
• Temperature Unit
(UDO)
• APP Download
(APP Download)
• DESCRIPTION
• STATE
• MAX_BLOCK_SIZE
• LAST_BLOCK_DOWNLOADED
• ERROR_CODE
(CO)
• Configuration
• Others
(Configuration)
• COMM_ENDPOINT
• COMM_CONTRACT
• PUB_ITEM_MAX
• PUB_ITEM_NUM
• PUB_ITEM
(COMM_ENDPOINT)
• Network address of remote endpoint
• Transport layer port at remote endpoint
• Object ID at remote endpoint
• Stale data limit
• Data publication period
• Ideal publication phase
• Publish Auto Retransmit
• Configuration status
(COMM_CONTRACT)
• Contract ID
• Contract Status
• Actual Phase
(PUB_ITEM)
• Object ID
• Attribute ID
• Attribute Index
• Size
(Others)
• REVISION
(TRANSDUCER)
• Block Info
• Configuration/Calibration
• Others
(Block Info)
• Tag Description
(Configuration/Calibration)
• Model
• Serial Number
• Wireless Status
• Display Selection
• LCD Intermittent Time
• LCD Exp Mode
• Measurement Rate
• Sensor Type
(Others)
• Special Cmd
• Change Sensor Type
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(2) Menu Tree

Menu Tree is depending on the connection device type. Refer to section 9 “Connection Device Type” for the menu tree of our recommended device configuration tool.
Refer to subsection 8.2 “Recommended products list” for the device configuration tool of our recommendation.

7.3.3 Parameters for Wireless Communication

(1) Network Information

CO block: Configuration
The network-related information can be checked.

(2) Update Time

CO block: Data publication period
Set the update time value to 8 to 3600 seconds.
The setting affects the battery life.
When update time is set 0 second, FN310 stops updating process variables via the field wireless network. And it also stops the acquisition of process variables from the Modbus device.

(3) Remaining Battery Life

UAPMO block: Energy Left
The number of days of battery life remaining is indicated assuming ambient temperature condition as 23 °C. It takes several days for the value to be stabilized after the power on and initialization of the remaining battery life.
UAPMO block: Reset Energy Left
When changing batteries, the remaining battery life is initialized by Reset Energy Left parameter.

(4) LCD Display

TRANSDUCER block: LCD Intermittent Time
The integral indicator has three modes: Continuous, Intermittent, and Off. These modes are switched by LCD Intermittent Time parameter. The intermittent mode repeats on/off at defined seconds.
In any mode, current process value is displayed by magnet switch operation. After displaying current process value, returns to the configured mode.
Refer to subsection 8.6 “Switching LCD Display” for details.

NOTE

When the FN310 detects AL.01, AL.02 and AL.03 error, the LCD display does not dim regardless of the status in LCD mode. See Table 8.4 for details.

7.3.4 Tag and Device Information

You can specify the Device Tag when ordering the corresponding FN110 Field Wireless Communication Module.
Device Tag and device information can be checked as follows.

■ **Procedure to Read the Device Tag and Device Information**

- Device Tag (Software Tag)
  This is specified by writing characters (up to 16 characters) that differs from those specified in Tag No. to the module. For details how to confirm this, refer to subsection “Connecting to the Field Wireless Network”.
- Tag Description
  This is a universal parameter to store the comment that describes the content of the tag located in the TRANSDUCER and AI1/AI2/AI3/AI4 blocks.

■ **Limitation of Device Information**

When changing the device information, input the information based on the following limitation on the number of characters.

- Message function (up to 32 characters)
  TRANSDUCER block: Tag Description
  AI1/AI2/AI3/AI4 block: Tag Description

7.3.5 Setup the Integral Indicator

TRANSDUCER block: LCD Exp Mode
Set the display method of the PV on the integral indicator. Index display or base display is selectable

7.3.6 Parameters for Modbus Device

Parameters for Modbus device is depending on the connection device type. Refer to section 9 “Connection Device Type”.

7.3.7 Assignment to AI Object

FN310 has four AI blocks. Input value of Process Value parameters for each AI block depends on the setting of the Sensor Type parameter of TRANSDUCER block. Refer to section 9 “Connection Device Type”.

7.3.8 Write Protect

Hardware write protection and software write protection functions are available for FN310.

■ **Hardware Write Protection**

Hardware Write Protection is set by slide switch on the front panel back.

■ **Software Write Protection**

Software Write Protection is set by the parameter of software write protect of UAP Option in UAPMO block.
For the relationship between hardware write protection and software write protection, refer to subsection 9.1.10 “Parameter Summary”.

7.3.9 Switching to the Deep Sleep Mode

When the FN310 will not be used for a long time, switch the FN310 to the deep sleep mode to conserve battery power. There are two methods of switching to the deep sleep mode. To switch to deep sleep mode, follow the procedure below.

■ **Magnet Switch Operation**

Procedures for switching to the deep sleep mode using a magnet switch are as follows.

1. Touch the magnet switch 1 for 5 seconds by a magnet (LCD displays “SLEEP” flashing).
2. Touch the magnet switch 1 for an additional 5 seconds by a magnet (LCD displays “SLEEP”).
3. Touch the magnet switch 2 within next 5 seconds by a magnet.

■ **Write Parameter**

TRANSDUCER block: Special Cmd
Set deep sleep mode to Special Cmd parameter.
There are three methods to start from the deep sleep mode.

■ **Restart**

Restart by re-connection of the battery pack.

■ **Infrared Communication**

Start by receiving infrared communication. Use the wireless field device configuration tool (for infrared) or device provisioning tool.

■ **Magnet Switch Operation**

Start by touching a magnet to magnet switch 1 for 10 seconds.

CAUTION

After setting the deep sleep mode by infrared device configuration tool, keep the infrared port of device away from any other infrared signals.

NOTE

- After switching to deep sleep mode, the FN310 stops any field wireless communication. For this reaon, there is the case that an error is display on field wireless configuraiton tool.
- To wake up from deep sleep mode by reconnection of battery pack, please pull battery pack and wait more than 30 seconds before attaching battery pack.

7.3.10 Switching to the Silence Mode

This is a function to pause the FN310 when it cannot join the field wireless network after a specified time has elapsed. This function is effective in conserving battery power when, for example, the installation of the Field Wireless Integrated Gateway is delayed compared to that of field wireless devices. When the FN310 fails to search the network for about 120 minutes, it switches to silence mode automatically. Thereafter, a cycle of 18 minutes pause and 36 seconds search is repeated until the FN310 can join the field wireless network. To minimize the consumption of the battery, the FN310 turns off the integral indicator and stops the measurement.
To start from the silence mode, either removes and inserts the battery pack, or receiving infrared communication. Use the device configuration tool (for infrared) or device provisioning tool.

7.4 Self-Diagnostics

7.4.1 Identify Problems by Using the Device Configuration Tool

The device configuration tool allows checking the self-diagnostic results and settings of the FN310. First, check Diagnostic Status of the self-diagnostic results. For details of Diagnostic Status, refer to section 9 “Connection Device Type”.

■ **Procedure to Call Up the Self-Diagnostic Parameter**

UAPMO block: Diagnostic Status
Any of the four categories (Function check, Maintenance required, Failure, and Out of specification) according to NAMUR NE107 is supplied to Diagnostic Status of each diagnostic result.

Checking the Diagnostic Status category allows taking the proper action. The Diagnostic Status contents are common for all ISA devices, and the setting for the Diagnostic Status category can be changed. For further details, refer to Diagnostic Status Detail.
In Diagnostic Status Contents that can be diagnosed by the FN310, the alert category set in Out of Service can be changed to Function check. To do so, follow the procedures below.

1. UAPMO block: UAP Option Enable diagnostic status configuration select “enable”.
2. UAPMO block: Diagnostic Configuration change Out of Service from “Failure” to “Function check”.
3. UAPMO block: UAP Option Enable diagnostic status configuration, select “disable”.

In Diagnostic Configuration setting, select one from the followings;

F: Failure Status
C: Function check status
O: Out of specification status
M: Maintenance required status

The contents of Diagnostic Status are defined either valid or invalid at Diagnostic Switch parameter. Follow the example below to change “Out of Service” to invalid.

1. UAPMO block: UAP Option Enable diagnostic status configuration select “enable”.
2. UAPMO block: Diagnostic Switch turns “Off” for Out of Service.
3. UAPMO block: UAP Option Enable diagnostic status configuration, select “disable”.

NOTE

Be careful when changing the alert category and turning detection on and off as described above. Be sure to set UAP Option Enable diagnostic status configuration to disable again to prevent setting errors.

7.4.2 Alert Report

FN310 generates alert information related to Diagnostic Status and automatically sends to a field wireless gateway. To use this function, the following alert setting is necessary. When “Out of Service” for Diagnostic Status alert is required, choose “FALSE” for [Out of Service.Alert Disable] in the UAPMO block. Refer to the field wireless gateway User’s Manual for the setting procedure to obtain the alert information from the gateway.
The alert report consists of the list of parameter name as shown Table 7.2.

Table 7.2 Contents of Alert Report

Parameter name	Description
DetectObjectTLPort	Alert detection port UAP (0xF0B2) fixed
DetectObject	Alert detection block UAPMO (1) fixed
DetectTime	Time stamp
AlertDirection	1: generated, 0: clear
AlertPriority	Alert priorities set by users
AlertType	Alert types, see Alert Type of Diagnostic Results Summary in section 9 “Connection Device Type”.
AlertValue	NAMUR107 category 0: Failure 1: Function Check 2: Out Of Specification 3: Maintenance Required

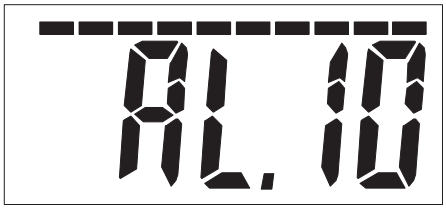
CAUTION

For a wireless gateway which does not support the alert report function, the alert setting in UAPMO block for this product must be set to “Disable”. Note that YFGW710 Field Wireless Integrated Gateway does not have the alert report function.

7.4.3 Checking with Integral Indicator

NOTE

If an error is detected by running self-diagnostics, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at 2 seconds interval. For details of the alarm codes, refer to section 9 “Connection Device Type”.



F0703.ai

Figure 7.2 Error Check with Integral Indicator

Table 7.3 Diagnostic Status

Bits	Contents	NAMUR NE107 Categorization*
Bit31(MSB)	F:Failure status	---
Bit30	C:Function check status	---
Bit29	O:Out of specification status	---
Bit28	M:Maintenance required status	---
Bit27	Faults in electronics	F
Bit26	Faults in sensor or actuator element	F
Bit25	Installation, calibration problem	C
Bit24	Out of service	C
Bit23	Outside sensor limits	O
Bit22	Environmental conditions out of device specification	O
Bit21	Fault prediction: Maintenance required	M
Bit20	Power is critical low: maintenance need short-term	M
Bit19	Power is low: maintenance need mid-term	M
Bit18	Software update incomplete	C
Bit17	Simulation is active	C
Bit16	Faults due to process influence	F
Bit15	Faults due to non-compliance with specified operating conditions	F
Bit14	Other faults	F
Bit13-Bit09	reserved by WCI	---
Bit08	Connected device: Failure	F
Bit07	Connected device: Function Check	C
Bit06	Connected device: Out of Specification	O
Bit05	Connected device: Maintenance required	M
Bit04-Bit01	vendor specific area	---
Bit00	Detail information available	---
	1: available	
	0: no available	

*:NAMUR NE107 “Self-Monitoring and Diagnosis of Field Devices”

8. Maintenance

8.1 General

This chapter describes the procedures of replacing batteries and the status check method required for maintenance of FN310.
Please carefully and thoroughly read the following sections for information on how to properly handle this product while performing maintenance.

8.2 Recommended Products List

Table 8.1 lists the recommended products of our equipment needed to set up and use the FN310.

Table 8.1 Recommended Products List

Yokogawa-recommended Instrument
Provisioning Device Tool • FieldMate (R3.01 or later) • Provisioning Device Tool • Infrared Adapter certified by Yokogawa Supplier: ACTiSYS Product name: IrDA InfraRed USB Adaptor Product number: IR224UN-LN96 (9600bps)
Field Wireless Configuration Tool • Field Wireless Integrated Gateway attached Software Field Wireless Configurator Field Wireless Management Tool • Field Wireless Management Station attached Software Field Wireless Management Console
Device Configuration Tool • FieldMate (R3.01.11 or later) DeviceFile (R3.06.01 or later)
Field Wireless System related Product • Plant Resource Manager (PRM) (scheduled to be supported) DeviceFile (scheduled to be supported)

8.3 Replacing the Battery Pack

■ Preparation

Initialize the value of remaining battery life.
To initialize the battery life, set the Reset Energy Left parameter in UAPMO block. When the FN310 stop working because of low battery, initialize the remaining battery life immediately after replacing the battery pack. In the case of initialize the remaining battery life after replacing the battery pack, perform warm restart after initializing. For details on how to warm restart, refer to field wireless gateway User's Manual (IM 01W02D01-01EN for YFGW410, IM 01W01F01-01EN for YFGW710).

■ Removing

1. Loosen the four screws on the front panel.
2. Pull out the battery connector from the front panel back.
3. Pull the battery pack.

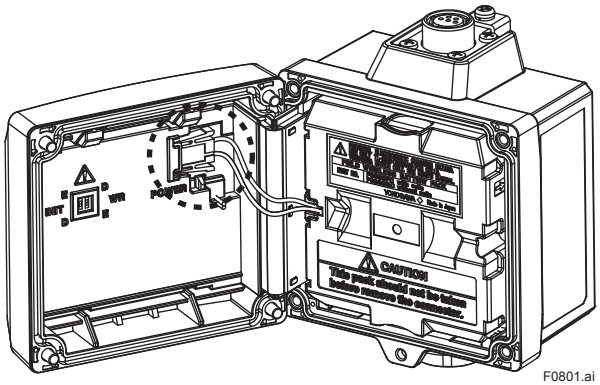


Figure 8.1 Removing the Battery Pack

CAUTION

After pulling out the battery connector, remove the battery pack.

■ Remounting

1. Insert the new battery pack. The orientation of the battery pack, CAUTION display is the front and connector cable is left side.
2. Plug the battery connector into the terminal on the front panel back. Connect facing down the white surface of the connector. Push the connector until it touches the back of the front panel then slide it to the left.
3. Close the front panel and tighten the four screws to a torque of 0.7 N • m.

CAUTION

The opening and closing the front panel, be careful not to pinch your finger.

8.4 Replacing the Batteries

The batteries in the battery pack can be replaced. Batteries are not installed when shipped from the factory. Assemble the battery pack as follows.

WARNING

Be sure to replace the batteries or open and close the battery pack in a non-hazardous area. Doing so in a hazardous area could cause an explosion.

CAUTION

When replacing the batteries, be sure to replace the two batteries at the same time and do not use an old and a new battery together.

■ Disassembling

1. Loosen a battery case fixing screw.
2. Remove old batteries. Remove the battery by pushing up the negative side of the battery as shown in Figure 8.2.

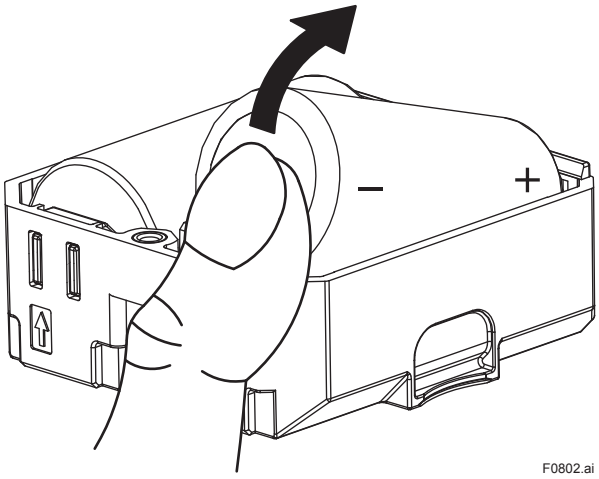


Figure 8.2 Remove Batteries

■ Assembling

1. Insert new batteries into the battery case. Check the orientation of the battery and push straight.
2. As shown in Figure 8.3, engage the hooks on the opposite side of the screw.
3. Tighten the screw to a torque of 0.7 N • m.

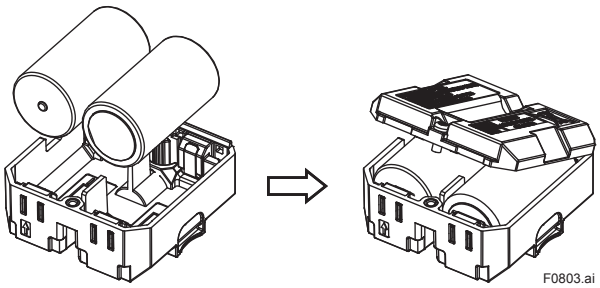


Figure 8.3 Assembling the Battery Pack

8.5 Handling Batteries

This battery pack uses two primary lithium-thionyl chloride batteries. Each battery contains approximately 5 grams of lithium, for a total of 10 grams in each pack. Under normal conditions, the battery materials are self-contained and are not reactive as long as the batteries and the pack integrity are maintained. Care should be taken to prevent thermal, electrical or mechanical damage. Protect the electrode of the battery pack to avoid rapid electrical discharge. Discharged a battery may lead to fluid leakage and excessive heat. Batteries should be stored in a clean and dry area. For maximum battery life, storage temperature should not exceed 30°C.

WARNING

Handling the battery pack

The following precautions must be observed in order to safely and effectively use a battery pack. Improper use may lead to fluid leakage, excessive heat, ignition, or explosion.

- Never charge it.
- Do not short-circuit it.
- Do not disassemble, transform, or modify it.
- Do not heat it or throw it into a fire.
- Do not soak it in fresh water or seawater.

CAUTION

Observe the following precautions for the safe disposal of batteries.

- Do not incinerate the battery, and do not expose it to a high temperature of 100°C or more. This may lead to fluid leakage or explosion.
- Dispose of the battery according to laws and regulations.

Use the following dedicated parts for the battery pack and batteries.

■ **Battery Pack**

Part number: F9090FD *1(with batteries)
Part number: F9090GD *2(without batteries)

■ **Batteries**

Part number: F9915NR
Alternatively, following batteries may be purchased and used.

- Tadiran TL-5930/S or SL-2780/S
- VITZROCELL SB-D02

*1: If you need F9090FC, please purchase F9090FD. F9090FD is a set of F9090FC and instruction manual.
*2: If you need F9090GC, please purchase F9090GD. F9090GD is a set of F9090GC and instruction manual.

Transportation of products containing lithium batteries

Batteries used for this product contain lithium. Primary lithium batteries are regulated in transportation by the U.S. Department of Transportation, and are also covered by the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), and the European Ground Transportation of Dangerous Goods (ARD). It is the responsibility of the shipper to ensure compliance with these or any other local requirements. Consult current regulations and requirements before shipping. When transporting this product with the battery pack inserted, keep it in deep sleep mode in order to conserve battery power. For details on how to switch to deep sleep mode, refer to subsection 7.3.9 “Switching to the Deep Sleep Mode”.

Procedure to replace and dispose of the batteries of the product

Below an explanation about the new EU Battery Directive (DIRECTIVE 2006/66/EC). This directive is only valid in the EU.
Batteries are used for this product. When you remove batteries from this product and dispose them, discard them in accordance with domestic law concerning disposal.
Take a right action on waste batteries, because the collection systems in the EU on waste batteries are regulated.
Battery type: Primary lithium-thionyl chloride battery
Crossed-out dustbin symbol

NOTE

The symbol (see above), which is marked on the batteries, means they shall be sorted out and collected as ordained in ANNEXII in DIRECTIVE 2006/66/EC

Procedure to remove the batteries safely
Refer to subsection 8.3 “Replacing the Battery Pack” and subsection 8.4 “Replacing the Batteries”.

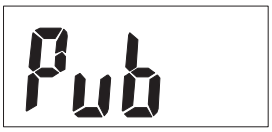
8.6 Switching LCD Display

The process value and the wireless communication status are displayed on the LCD by touching a magnet to the magnet switch1. The contents of the display changes as follows every two seconds.

1. Wireless Communication Status. See Table 8.2.
2. Object Name (AI1)
3. Process Value of AI1 block
4. Object Name (AI2)
5. Process Value of AI2 block
6. Object Name (AI3)
7. Process Value of AI3 block
8. Object Name (AI4)
9. Process Value of AI4 block
10. Tag No. (If specified when ordering)

After display, return to normal display contents.

Table 8.2 Wireless Status

Integral Indicator	Description
F0804.ai	Searching for Backbone Router or Router to connect. It is not connected to the field wireless network.
F0805.ai	Discovering the connection destination, and is doing the Join process. It is not connected to the field wireless network.
F0806.ai	Complete the Join process and is doing the Publish settings.
 F0807.ai	The publish setting is complete and has been sent the PV value to the field wireless network.
F0808.ai	Silence Mode. For more information about silence mode, refer to subsection 7.3.10 “Switching to the Silence Mode”.

8.7 Replacing the FN110

This subsection describes the procedure for replacing the FN110. Replace the FN110 as follows.

1. Back up the configuration of the FN310.
2. Remove the battery pack.
3. Remove the FN110, and install a new FN110.
4. Remounting the battery pack.
5. Restore the backed up configuration of the FN310.
6. Performing provisioning work.
7. Update the configuration of field wireless gateway.

To back up the configuration, use the device configuration tool, such as FieldMate.
Performing provisioning work is necessary when replacing the FN110. Update the configuration information of the target device by using field wireless configuration tool. For details of provisioning, refer to subsection 6.3 “Connecting to the Field Wireless Network”.

8.8 Replacing the FN310

This subsection describes the procedure for replacing the FN310. Replace the FN310 as follows.

1. Back up the configuration of the FN310.
2. Remove the battery pack.
3. Remove the FN110 and the Modbus device, and install them to the new FN310.
4. Remounting the battery pack.
5. Restore the backed up configuration of the FN310.

8.9 Replacing the Modbus Device

This subsection describes the procedure for replacing the Modbus device.
Replace the Modbus device as follows.

1. Remove the battery pack.
2. Disconnect the Modbus device from the FN310.
3. Connect the new Modbus device to the FN310. If necessary, configure the Modbus device before installing.
4. Remounting the battery pack.

8.10 Troubleshooting

If any abnormality appears in the measured values, use the troubleshooting flow chart below to isolate and resolve the problem. Since some problems have complex causes, these flow charts may not identify all. If you have difficulty isolating or correcting a problem, contact Yokogawa service personnel.

8.10.1 Basic Troubleshooting Flow

First determine whether the process variable is actually abnormal or a problem exists in the measurement system. If the problem is in the measurement system, isolate the problem and decide what corrective action to take.
FN310 is equipped with a self-diagnostic function which will be useful in troubleshooting, and this product is equipped with an integral indicator and it will show an alarm code as a result of self-diagnosis.
See “Errors and Countermeasures” in the section 9 “Device Connection Type” for the list of alarms.

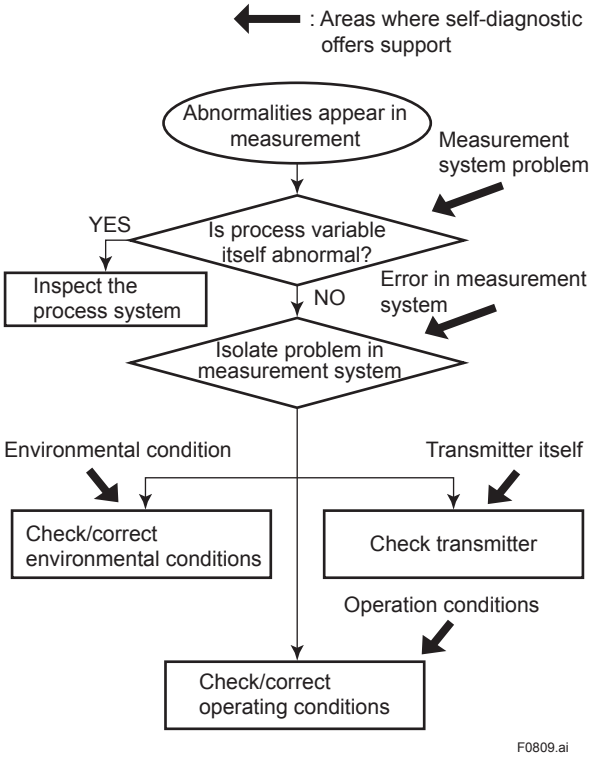


Figure 8.4 Basic Troubleshooting Flow

8.10.2 Example of Troubleshooting Flow

The following shows an example of the flow for troubleshooting.
Refer to this example and Table 8.3. Locate the problem and take the corresponding countermeasure.

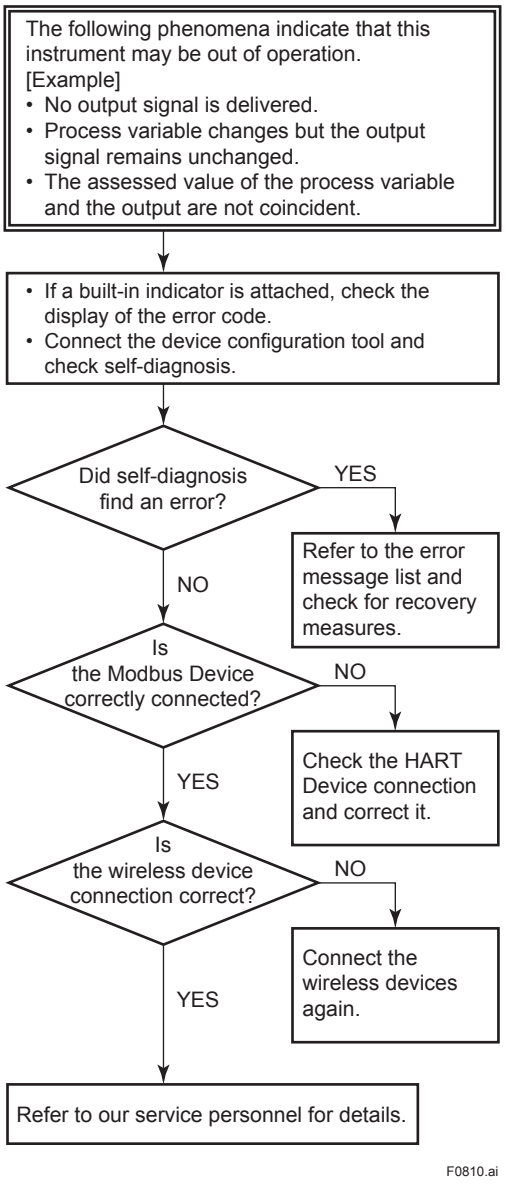

The following phenomena indicate that this instrument may be out of operation.
[Example]
• No output signal is delivered.
• Process variable changes but the output signal remains unchanged.
• The assessed value of the process variable and the output are not coincident.
• If a built-in indicator is attached, check the display of the error code.
• Connect the device configuration tool and check self-diagnosis.
Did self-diagnosis find an error?
YES
Refer to the error message list and check for recovery measures.
NO
Is the Modbus Device correctly connected?
NO
Check the HART Device connection and correct it.
YES
Is the wireless device connection correct?
NO
Connect the wireless devices again.
YES
Refer to our service personnel for details.
F0810.ai

Figure 8.5 Example of Troubleshooting Flow

Table 8.3 Cause and Countermeasure

Observed Problems	Possible Cause	Countermeasure	Related Parameter
Outputs fixed current.	The simulation function is set to On	Set the simulation function to Off.	• Simulate Switch
Parameters cannot be changed.	This product is in write protect status.	Release write protect.	• UAP Option • Hardware Write Protect

8.10.3 Errors and Countermeasures

For errors and countermeasures, refer to section 9 “Device Connection Type”.

9. Connection Device Type

This section describes the detailed information of each device connecting to the FN310. Refer to the subsection of the corresponding device.

9.1 SENCOM FU20F-NPT

This subsection describes the detailed information when DT2 is specified in the connection device type. SENCOM FU20F Digital pH/ORP-sensor (hereafter simply referred to as SENCOM) is used by connecting to the FN310. FN310 transmits the various measurement value such as pH, ORP, rH and temperature acquired from SENCOM to the host system. When temperature compensation is required, perform processing by the host system.

NOTE

When replace SENCOM for maintenance, remove the battery pack at first.

9.1.1 Cable Selection

Use the dedicated cable WU11 SENCOM cable provided by Yokogawa. For details of the cable, refer to General Specifications of SENCOM (GS 12B6J3-04E-E).

9.1.2 Connecting Input Terminal and Grounding Terminal

Connect SENCOM as shown in Figure 9.1.

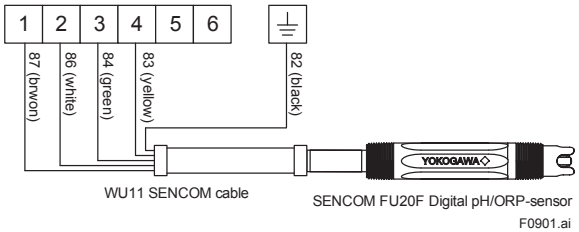


Figure 9.1 Connection of SENCOM

9.1.3 Preparation for Starting Operation

■ Setting the FN310

Confirm the following settings of the FN310.
SENCOM Interface block: Transmitter Status Alert Mask
Set the impedance error to detect when the sensor status changes. When detecting the state of the target and the setting is enabled, FN310 sends alert.

■ SENCOM FU20F-NPT

Perform the calibration before connecting SENCOM. For details of the calibration, refer to General Specifications of SENCOM (GS 12B6J3-04E-E).

9.1.4 Parameters for Wireless Communication

Update Time

CO block: Data publication period
Set the update time value to 8 to 3600 seconds.
The setting affects the battery life.
When update time is set 0 second, FN310 stops updating process variables via the field wireless network. And it also stops the acquisition of process variables from SENCOM.
When set the update time shorter than 241 seconds, FN310 supplies power continuously to SENCOM.

9.1.5 SENCOM Specific Parameters

SENCOM Interface block: Stable Time
Stable Time is defined as the time until the reliable data is available. The unit is second. This value is depending on the liquid temperature of the measurement target. When the FN310 supplies power continuously, this value is zero.
FN310 returns a response after acquiring reliable data. When the liquid temperature to be measured is low, time-out of the device configuration tool may occur. At that time, set the update time of FN310 to 241 seconds or less to supply power continuously.

9.1.6 Assignment to AI Object

FN310 has four AI blocks. Input value of Process Value parameters for each AI block depends on the setting of the Sensor Type parameter of TRANSDUCER block. Table 9.1 shows the relation between Sensor Type and assignment to AI Object.

Table 9.1 Assignment to AI Object

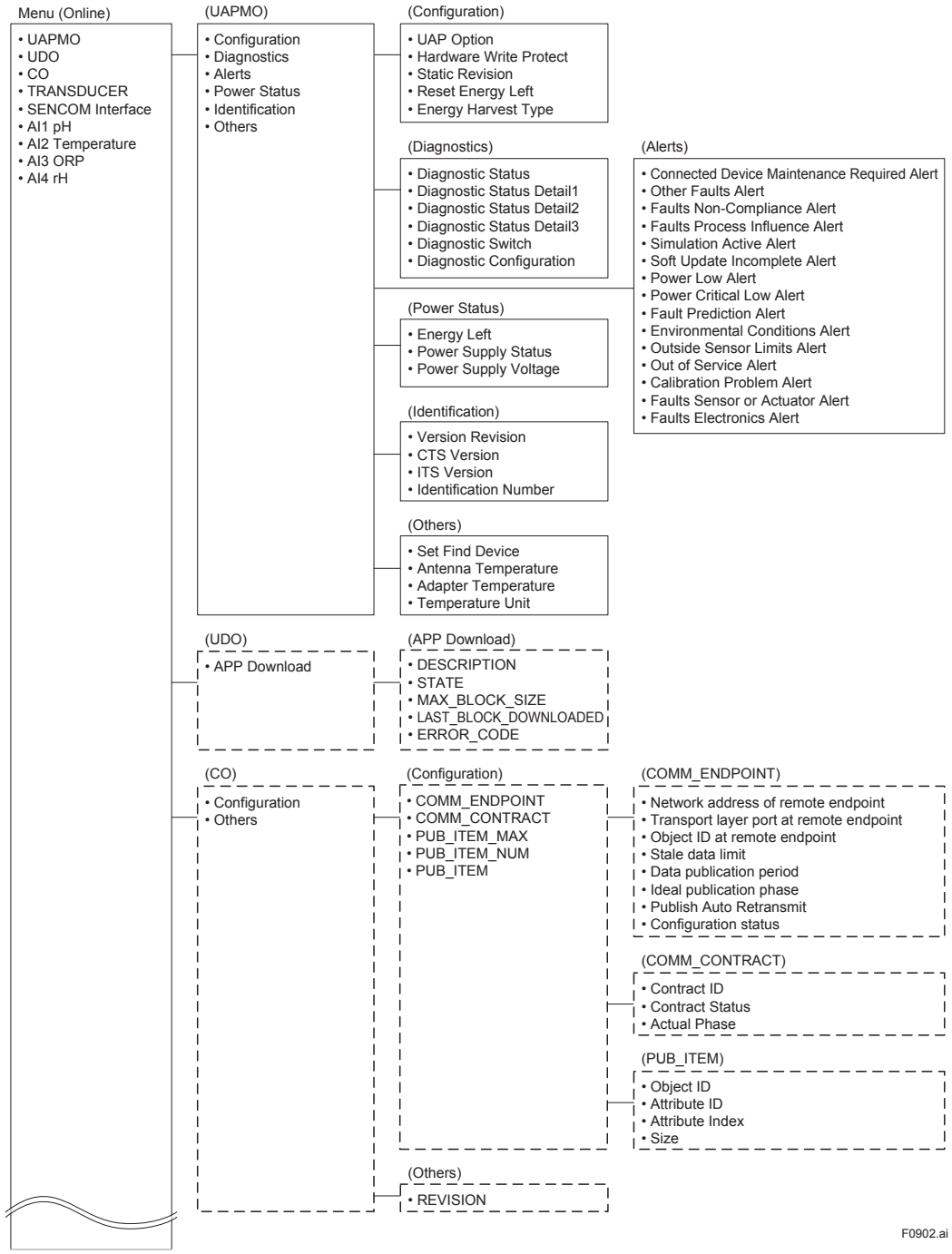
AI Object	TRANSDUCER.Sensor Type	
	20: SENCOM sensor	21: Not Used
AI1	pH	UAPMO.EnergyLeft*
AI2	Temperature	Not Assigned
AI3	ORP	Not Assigned
AI4	rH	Not Assigned

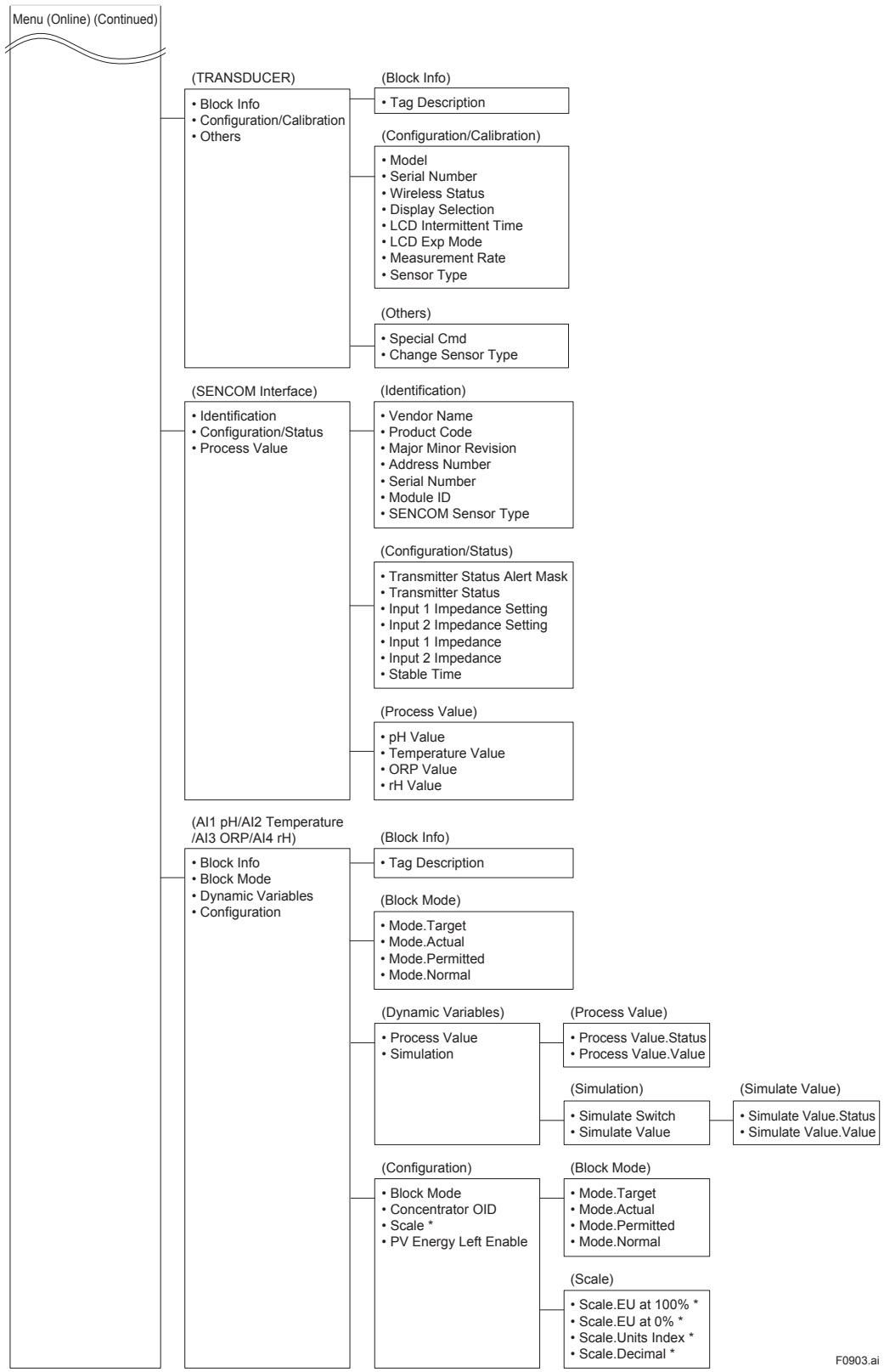
*: Disabled by default

9.1.7 Function Block and Menu Tree

(1) Function Block

The function of FN310 is shown below. Some functions may not be available depending on the device configuration tool used. When the device configuration tool of our recommendation is used, the software attached to the Field Wireless Integrated Gateway or Field Wireless Management Station is necessary for setting the dotted line part. Refer to subsection 8.2 “Recommended Products List” for the field wireless configuration tool of our recommendation.

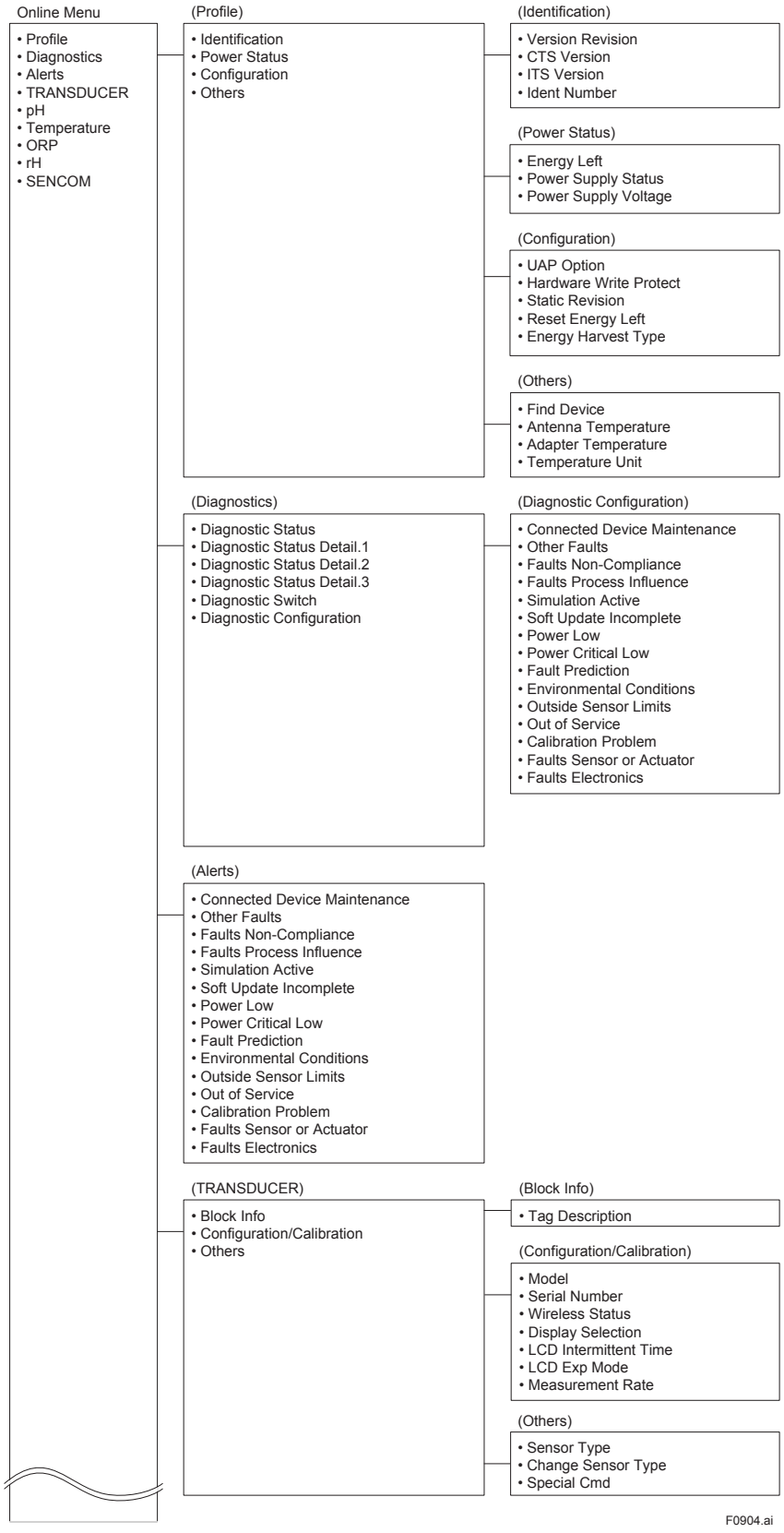


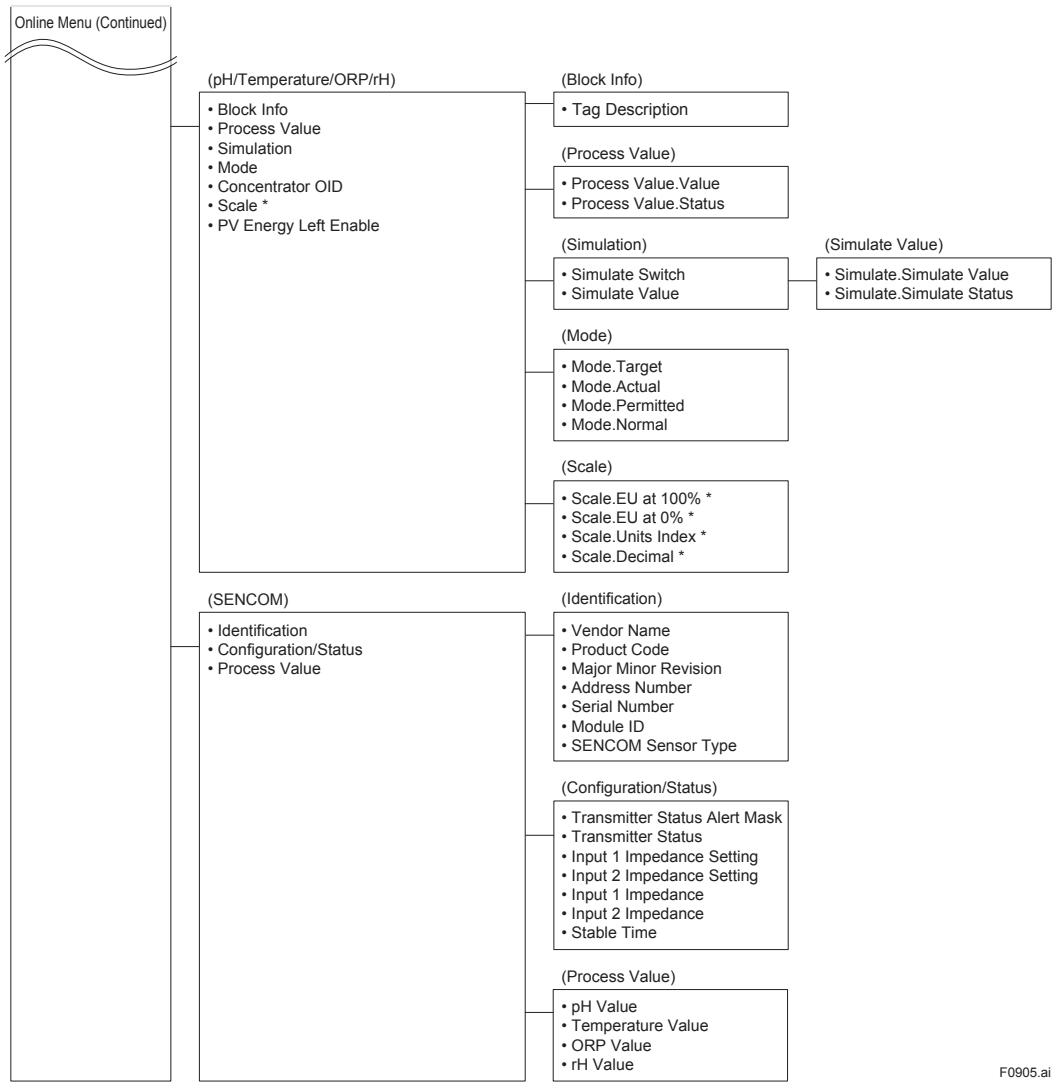


*: When the data of these parameters is rewritten, it is necessary to set the operational mode of the block to O/S (Out of Service).

(2) Menu Tree

The menu tree of our recommended device configuration tool is shown below.
Refer to subsection 8.2 “Recommended products list” for the device configuration tool of our recommendation.





*: When the data of these parameters is rewritten, it is necessary to set the operational mode of the block to O/S (Out of Service).

9.1.8 Self-Diagnostics

Table 9.2 Diagnostic Results Summary

Diagnostic Status Contents	Alert Type	NAMUR NE107 Category *	Diagnostic Status Detail	Description
Faults in electronics	78	F	ADAPTER FAIL	FN310 failure
			ANTENNA FAIL	FN110 failure
			RS485 FAIL	Communication failure between FN110 and FN310
Faults in sensor or actuator element	77	F	SENSOR FAIL	Communication failure between FN310 and Modbus devices
Installation, calibration problem	76	C	DEVICE CONNECTION ERR	Connection failure between FN310 and Modbus devices
			DEVICE PUBLISH INTERVAL ERR	Delay of SENCOM start-up time due to the low temperature of the measurement target
Out of service	75	C	AI1 OUT OF SERVICE	AI1 O/S Mode
			AI2 OUT OF SERVICE	AI2 O/S Mode
			AI3 OUT OF SERVICE	AI3 O/S Mode
			AI4 OUT OF SERVICE	AI4 O/S Mode
Environmental conditions out of device specification	73	O	ADAPTER TEMP HI	FN310 temperature is above +85°C
			ADAPTER TEMP LO	FN310 temperature is below -40°C
			ANTENNA TEMP HI	FN110 temperature is above +85°C
			ANTENNA TEMP LO	FN110 temperature is below -40°C
Power is critical low: maintenance need short-term	71	M	CRITICAL LOWBAT	Low battery alert
Power is low: maintenance need mid-term	70	M	LOWBAT_ALM	Low battery
Simulation is active	68	C	AI1 SIMULATION ACTIVE	AI1 Simulation Mode
			AI2 SIMULATION ACTIVE	AI2 Simulation Mode
			AI3 SIMULATION ACTIVE	AI3 Simulation Mode
			AI4 SIMULATION ACTIVE	AI4 Simulation Mode
Connected device Maintenance required	56	M	DEVICE IMPEDANCE1 TOO HIGH	Input1 impedance value of SENCOM is high
			DEVICE IMPEDANCE1 TOO LOW	Input1 impedance value of SENCOM is low
			DEVICE IMPEDANCE2 TOO HIGH	Input2 impedance value of SENCOM is high
			DEVICE IMPEDANCE2 TOO LOW	Input2 impedance value of SENCOM is low

*: NAMUR NE107 “Self-Monitoring and Diagnosis of Field Devices”

9.1.9 Errors and Countermeasures

Table 9.3 Error Message Summary

Integral indicator	NAMUR NE107 category*1	Bit	Diagnostic Status	Diagnostic Status Detail	Cause	Release/ recovery conditions (except restart) *2	Output Operation	Action
AL.01*3	F	27	Faults in electronics	ADAPTER FAIL	FN310 failure	None	Output value: Hold previous value Output status: BAD Device Failure	Contact Yokogawa service personnel.
AL.02*3				ANTENNA FAIL	FN110failure			
AL.03*3				RS485 FAIL	Communication failure between FN110 and FN310	Recovers communication between FN110 and FN310		Check the connection between FN110 and FN310
AL.10	F	26	Faults in sensor or actuator element	SENSOR FAIL	Disconnection or communication error, between the Modbus device and FN310	None	Output value: Hold previous value Output status: BAD Sensor Failure	Check the installation environment of Modbus devise and connecting method of Modbus devices and FN310.
AL.20	M	20	Power is critical low: maintenance need short-term	CRITICAL LOWBAT	Low remaining battery voltage	None	Normal action	Replace the batteries.
		19	Power is low: maintenance need mid-term	LOWBAT ALM	Low remaining battery voltage			
AL.45	O	22	Environmental conditions out of device specification	ADAPTER TEMP HI	FN310 temperature is above +85°C	Recovers when the temperature returns to +85°C below	Normal action	Check the ambient temperature of the FN310
				ADAPTER TEMP LO	FN310 temperature is below -40°C	Recovers when the temperature returns to -40°C or more		
				ANTENNA TEMP HI	FN110 temperature is above +85°C	Recovers when the temperature returns to +85°C below		Check the ambient temperature of the FN110
				ANTENNA TEMP LO	FN110 temperature is below -40°C	Recovers when the temperature returns to -40°C or more		

Integral indicator	NAMUR NE107 category*1	Bit	Diagnostic Status	Diagnostic Status Detail	Cause	Release/ recovery conditions (except restart) *2	Output Operation	Action
AL.50	C	25	Installation, calibration problem	DEVICE CONNECTION ERR	Connection error between the Modbus device and FN310	None	Output value: Hold previous value Output status: BAD Configuration Err	Check the wiring between the Modbus device and FN310
AL.52				DEVICE PUBLISH INTERVAL ERR	Delay of SENCOM start-up time due to the low temperature of the measurement target	Change the update time corresponding to the temperature characteristics of SENCOM		Check the update time and temperature characteristics of SENCOM. For the temperature characteristics of SENCOM, refer to the user's manual of SENCOM.
AL.60	C	24	Out of service	AI1 OUT OF SERVICE	AI1 block is O/S mode	Recover when the mode target of alert block is other than O/S	Output value: Hold previous value Output status: BAD Configuration Err	Check the AI1 block setting
				AI2 OUT OF SERVICE	AI2 block is O/S mode			Check the AI2 block setting
				AI3 OUT OF SERVICE	AI3 block is O/S mode			Check the AI3 block setting
				AI4 OUT OF SERVICE	AI4 block is O/S mode			Check the AI4 block setting
AL.61	C	17	Simulation is active	AI1 SIMULATION ACTIVE	Simulate Switch of AI1 block is enabled	Recover when the Simulate Switch of target block is set to disable	Output Simulate Value of AI1 block	Check the AI1 block setting
				AI2 SIMULATION ACTIVE	Simulate Switch of AI2 block is enabled		Output Simulate Value of AI2 block	Check the AI2 block setting
				AI3 SIMULATION ACTIVE	Simulate Switch of AI3 block is enabled		Output Simulate Value of AI3 block	Check the AI3 block setting
				AI4 SIMULATION ACTIVE	Simulate Switch of AI4 block is enabled		Output Simulate Value of AI4 block	Check the AI4 block setting

Integral indicator	NAMUR NE107 category*1	Bit	Diagnostic Status	Diagnostic Status Detail	Cause	Release/ recovery conditions (except restart) *2	Output Operation	Action
AL.80	M	5	Connected device Maintenance required	DEVICE IMPEDANCE1 TOO HIGH	Input1 impedance value of SENCOM is high	None	Output value: Hold previous value Output status: BAD Sensor Failure	Perform the calibration of SENCOM using SPS24 SENCOM PC software
AL.81				DEVICE IMPEDANCE1 TOO LOW	Input1 impedance value of SENCOM is low			
AL.82				DEVICE IMPEDANCE2 TOO HIGH	Input2 impedance value of SENCOM is high			
AL.83				DEVICE IMPEDANCE2 TOO LOW	Input2 impedance value of SENCOM is low			

*1: “NAMUR NE107 category” refers to the four categories (C: Function check, M: Maintenance required, F: Failure, and O: Out of specification) according to NAMUR NE107 “Self-Monitoring and Diagnosis of Field Devices”.
*2: Except for the restart
*3: When the device detects “AL.01”, “AL.02”, and “AL.03”, integral indicator displays regardless of the LCD Mode.

9.1.10 Parameter Summary

Table 9.4 Parameter Summary

<table>
<tr><th>Object ID</th><th>Attribute ID</th><th>Label</th><th>Description</th><th>Default value</th><th>Handling *1</th></tr>
<tr><td rowspan="10">1. UAPMO block</td><td>1</td><td>Version Revision</td><td>Indicates the application revision of FN310. This revision changes when the application software is downloaded.</td><td>---</td><td>R</td></tr>
<tr><td>10</td><td>Static Revision</td><td>Indicates the revision level of the fixed parameters of UAP. Used, for example, to check whether parameters have been changed. This attribute is updated when information of Modbus devices is obtained.</td><td>---</td><td>R</td></tr>
<tr><td>64</td><td>Identification Number</td><td>Indicates the vendor ID, model ID, and revision of the device.</td><td>---</td><td>R</td></tr>
<tr><td>65</td><td>CTS Version</td><td>Indicates the version of the communication stack test system (CTS).</td><td>0</td><td>R</td></tr>
<tr><td>66</td><td>ITS Version</td><td>Indicates the version of the interoperability test system (ITS).</td><td>0</td><td>R</td></tr>
<tr><td>67</td><td>Diagnostic Status</td><td>Indicates the diagnostic results of the device based on the NAMUR NE107 *2 model.
Setting Enable diagnostic status configuration in UAP Option to Enable allows turning Off and On the display of the diagnostic results for each summary, and changing Categorize.</td><td>---</td><td>R</td></tr>
<tr><td>68</td><td>UAP Option</td><td>Allows setting the Diagnostic Status and write protection of UAP.
1. Software write protect
1: On, 0: Off (default)
2. Enable hardware write protect
1: Enable, 0: Disable (default)
3. Enable diagnostic status configuration
1: Enable, 0: Disable (default)
The following table shows the relationship between the hardware write protection and software write protection.
<table>
<tr><th>Enable hardware write protect</th><th>Hardware write protect</th><th>Software write protect</th><th>Write protect</th></tr>
<tr><td>Disable</td><td>Off or On</td><td>Off</td><td>No</td></tr>
<tr><td>Disable</td><td>Off or On</td><td>On</td><td>Protected</td></tr>
<tr><td>Enable</td><td>Off</td><td>Off or On</td><td>No</td></tr>
<tr><td>Enable</td><td>On</td><td>Off or On</td><td>Protected</td></tr>
</table></td><td>1. Off
2. Disable
3. Disable</td><td>W(P)</td></tr>
<tr><td>69</td><td>Diagnostic Switch</td><td>Allows setting On/Off for each summary of Diagnostic Status when Enable diagnostic status configuration in UAP Option is set to Enable.
1: On (default), 0: Off</td><td>On</td><td>W(P)</td></tr>
<tr><td>70</td><td>Diagnostic Configuration</td><td>Allows Categorize for each summary of Diagnostic Status when Enable diagnostic status configuration in UAP Option is set to Enable.
0x08: F:Failure status
0x04: C:Function check status
0x02: O:Out of specification status
0x01: M:Maintenance required status</td><td>Refer to Table 9.5.</td><td>W(P)</td></tr>
<tr><td>71</td><td>Find Device</td><td>When set a value other than 0, FN310 displays “Squ.” on the LCD. The value means the display duration. After displaying, this value returns to 0.
Unit: second
Range: 0 to 60</td><td>0</td><td>W</td></tr>
</table>

Object ID	Attribute ID	Label	Description	Default value	Handling *1
1. UAPMO block (continued)	102	Diagnostic Status Detail	Detailed information on Diagnostic Status.	Refer to Table 9.5	W
	103	Energy Left	Indicates the number of days of remaining battery life assuming ambient temperature condition as 23 degrees Celsius. Unit: day	---	R
	104	Reset Energy Left	Resets the remaining battery power calculation to restore it to a remaining battery power calculation which is based on new batteries. 0: Continue 1: Reset	0 (reading value is always 0)	W(P)
	105	Power Supply Status	Indicates remaining battery life and power supply of device. 0: line powered 1: battery powered, greater than 75% remaining capacity 2: battery powered, between 25% and 75% remaining capacity 3: battery powered, less than 25% remaining capacity	---	R
	106	Energy Harvest Type	Available to write note into this parameter.	---	W(P)
	107	Power Supply Voltage	Indicates the measured power supply voltage (V).	---	R
	110	Hardware Write Protect	Indicates the status of the hardware write protection switch. 0: Off 1: On	---	R
	111	Antenna Temperature	Indicates the temperature of the FN110.	---	R
	112	Adapter Temperature	Indicates the temperature of the FN310.	---	R
	113	Temperature Unit	Selects the temperature unit to be indicated on Antenna Temperature and Adapter Temperature. 1000: K 1001: °C (default) 1002: °F 1003: °R	°C	W(P)
	131	Connected Device Maintenance Alert	The On/Off or priority for Connected Device Maintenance Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	132	Connected Device Function Check Alert	The On/Off or priority for Connected Device Function Check Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	133	Connected Device Out Of Specification Alert	The On/Off or priority for Connected Device Out Of Specification Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	134	Connected Device Failure Alert	The On/Off or priority for Connected Device Failure Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)

Object ID	Attribute ID	Label	Description	Default value	Handling *1
1. UAPMO block (continued)	135	Other Faults Alert	The On/Off or priority for Other Faults Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	136	Faults Non-compliance Alert	The On/Off or priority for Faults Non-compliance Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	137	Faults Process Influence Alert	The On/Off or priority for Faults Process Influence Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	138	Simulation Active Alert	The On/Off or priority for Simulation Active Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	139	Soft Update Incomplete Alert	The On/Off or priority for Soft Update Incomplete Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	140	Power Low Alert	The On/Off or priority for Power Low Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	141	Power Critical Low Alert	The On/Off or priority for Power Critical Low Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	142	Fault Prediction Alert	The On/Off or priority for Fault Prediction Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	143	Environmental Conditions Alert	The On/Off or priority for Environmental Conditions Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	144	Outside Sensor Limits Alert	The On/Off or priority for Outside Sensor Limits Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	145	Out of Service Alert	The On/Off or priority for Out of Service Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	146	Calibration Problem Alert	The On/Off or priority for Calibration Problem Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)

Object ID	Attribute ID	Label	Description	Default value	Handling *1
1. UAPMO block (continued)	147	Faults Sensor or Actuator Alert	The On/Off or priority for Faults Sensor or Actuator Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
	148	Faults Electronics Alert	The On/Off or priority for Faults Electronics Alert can be set. 1. On/Off setting 0: On, 255: Off (default) 2. Alert report priority: 0 to 15 (default: 15)	1. Off 2. 15	W(P)
2. UDO block	2	DESCRIPTION	Indicates the version and model information of the downloaded data.	---	R
	3	STATE	Indicates the status of UAP block. 0: Idle 1: Downloading 3: Applying 4: DL Complete 6: DL Error	---	R
	5	MAX_BLOCK_ SIZE	Maximum block size. This value is smaller than the maximum data size of APDU.	---	R
	14	LAST_BLOCK_ DOWNLOADED	Indicates the last downloaded block number. 0 means that no block has been downloaded.	---	R
	16	ERROR_CODE	Indicates the error codes for DL Error. 0: no Error 1: Timeout 2: Client Abort 64: Apply failure	---	R
3. CO block	1	REVISION	Indicates the revision number such as COMM_ ENDPOINT, etc.	---	R
	2	COMM_ ENDPOINT	Indicates the Endpoint information. The following shows the components. 1. Network address of remote endpoint 2. Transport layer port at remote endpoint 3. Object ID at remote endpoint 4. Stale data limit 5. Data publication period 6. Ideal publication phase 7. Publish Auto Retransmit 8. Configuration status	---	W
	3	COMM_ CONTRACT	Indicates the Contract information. The following shows the components. 1. ContractID 2. Contract_Status 3. Actual_Phase	---	R
	4	PUB_ITEM_ MAX	Maximum PUB_ITEM value.	---	R
	5	PUB_ITEM_ NUM	PUB_ITEM number.	---	R
	6	PUB_ITEM	Indicates the PUB_ITEM information. The following shows the components. 1. ObjectID 2. AttributeID 3. AttributeIndex 4. Size	---	W

<table>
<tr><th>Object ID</th><th>Attribute ID</th><th>Label</th><th>Description</th><th>Default value</th><th>Handling *1</th></tr>
<tr><td rowspan="9">4. TRANSDUCER block</td><td>1</td><td>Tag Description</td><td>Memo field available to write anything.</td><td>Transducer</td><td>W(P)</td></tr>
<tr><td>2</td><td>Model</td><td>Indicates the model name of the FN310.</td><td>---</td><td>R</td></tr>
<tr><td>3</td><td>Serial Number</td><td>Indicates the serial number of the FN310.</td><td>---</td><td>R</td></tr>
<tr><td>4</td><td>Display Selection</td><td>Select PV Value displaying on the integral indicator.
0: AI1 (default)
1: AI2
2: AI3
3: AI4</td><td>AI1</td><td>W(P)</td></tr>
<tr><td>5</td><td>LCD Intermittent Time</td><td>Select the off time of the integral indicator.
0: Continuous mode
1: Intermittent mode
(off: 5 seconds, display: 2 seconds)
2: Intermittent mode
(off: 10 seconds, display: 2 seconds)
3: Intermittent mode
(off: 30 seconds, display: 2 seconds)
4: Intermittent mode (default)
(off: 60 seconds, display: 2 seconds)
5: Off mode</td><td>Intermittent mode (off: 60 seconds, display: 2 seconds)</td><td>W(P)</td></tr>
<tr><td>6</td><td>LCD Exp Mode</td><td>Select the notation of the integral indicator.
0: radix notation (default)
1: exponential notation</td><td>radix notation</td><td>W(P)</td></tr>
<tr><td>7</td><td>Wireless Status</td><td>Indicates the wireless communication status.
<table>
<tr><th>Bits</th><th>Contents</th><th>Value</th></tr>
<tr><td>Bit7-3</td><td>reserved</td><td>---</td></tr>
<tr><td>Bit2</td><td>Contract status (Client/Server)</td><td>0: Not established
1: Established</td></tr>
<tr><td>Bit1</td><td>Contract status (Publish)</td><td>0: Not established
1: Established</td></tr>
<tr><td>Bit0</td><td>Join status</td><td>0: Idle
1: Joined</td></tr>
</table></td><td>---</td><td>R</td></tr>
<tr><td>8</td><td>Measurement Rate</td><td>Indicates the publish period.
Unit: second</td><td>---</td><td>R</td></tr>
<tr><td>10</td><td>Special Cmd</td><td>Special function parameter.
0: Normal mode (default)
1: Deep-sleep mode</td><td>Normal mode</td><td>W</td></tr>
<tr><td>11</td><td>Sensor Type</td><td>Select the type of sensor to be connected to the FN310.
20: SENCOM sensor(default)
21: Not Used</td><td>SENCOM sensor</td><td>W(P)</td></tr>
<tr><td rowspan="3">8. SENCOM Interface block</td><td>64</td><td>Vendor Name</td><td>Indicates the Vendor Name of Modbus device connected to the FN310.</td><td>YOKOGAWA</td><td>R</td></tr>
<tr><td>65</td><td>Product Code</td><td>Indicates the Product Code of Modbus device connected to the FN310.</td><td>---</td><td>R</td></tr>
<tr><td>66</td><td>Major Minor Revision</td><td>Indicates the Device Revision number and Software Revision number of Modbus device connected to the FN310.
Format: dd-ssss
dd: Device Revision (Hexadecimal, 2 digit)
ssss: Software Revision (Hexadecimal, 4 digit)</td><td>---</td><td>R</td></tr>
</table>

<table>
<tr><th>Object ID</th><th>Attribute ID</th><th>Label</th><th>Description</th><th>Default value</th><th>Handling *1</th></tr>
<tr><td rowspan="12">8. SENCOM Interface block (continued)</td><td>70</td><td>Address Number</td><td>Indicates the Address of the Modbus device.</td><td>0</td><td>R</td></tr>
<tr><td>71</td><td>Serial Number</td><td>Indicates the Serial Number of the Modbus device.</td><td>---</td><td>R</td></tr>
<tr><td>72</td><td>Module ID</td><td>Indicates the Modbus ID of the Modbus device.
SENCOM FU20-F-NPT: PH (0x04)</td><td>0</td><td>R</td></tr>
<tr><td>80</td><td>SENCOM Sensor Type</td><td>Indicates the type of the electrodes of SENCOM.<table><tr><th>Type</th><th>Type of the Electrodes</th></tr><tr><td>158</td><td>pH</td></tr><tr><td>159</td><td>ORP</td></tr><tr><td>160</td><td>pH/ORP</td></tr></table></td><td>0</td><td>R</td></tr>
<tr><td>82</td><td>Input 1 Impedance Setting</td><td>Indicates the Input Impedance 1 setting of SENCOM.
It is always High when SENCOM is connected.
0: Low
1: High
2: Not Used (default)</td><td>Not Used</td><td>R</td></tr>
<tr><td>83</td><td>Input 2 Impedance Setting</td><td>Indicates the Input Impedance 2 setting of SENCOM.
It is always Low when SENCOM is connected.
0: Low
1: High
2: Not Used (default)</td><td>Not Used</td><td>R</td></tr>
<tr><td>89</td><td>Transmitter Status Alert Mask</td><td>Set the impedance error to detect when the Transmitter Status has changed. When enabled and detecting the state of the target, FN310 sends an Alert. It is disabled by setting the Bit each of the following.
Bit3: Impedance 2 Too Low
Bit2: Impedance 2 Too High
Bit1: Impedance 1 Too Low
(Unused in FN310)
Bit0: Impedance 1 Too High
(Unused in FN310)</td><td>0x0F</td><td>W(P)</td></tr>
<tr><td>90</td><td>Transmitter Status</td><td>Indicates the sensor status of SENCOM.
Indicates by setting the Bit each of the following.
Bit3: Input Impedance 2 Too Low
Bit2: Input Impedance 2 Too High
Bit1: Input Impedance 1 Too Low
Bit0: Input Impedance 1 Too High</td><td>0</td><td>R</td></tr>
<tr><td>91</td><td>pH Value</td><td>Indicates pH value.</td><td>0.000</td><td>R</td></tr>
<tr><td>92</td><td>Temperature Value</td><td>Indicates Temperature.</td><td>0.00</td><td>R</td></tr>
<tr><td>93</td><td>ORP Value</td><td>Indicates ORP Value.</td><td>0.0</td><td>R</td></tr>
<tr><td>94</td><td>rH Value</td><td>Indicates rH Value.</td><td>0.00</td><td>R</td></tr>
<tr><td>95</td><td>Input 1 Impedance</td><td>Indicates impedance value of the Input 1.
This means glass membrane resistance, and used to determine the presence or absence of damage to the glass electrode.<table><tr><th>Input 1 Impedance</th><th>Status</th></tr><tr><td><= 10 kΩ</td><td>Input 1 Impedance Too Low</td></tr><tr><td>>= 200000 kΩ</td><td>Input 1 Impedance Too High</td></tr></table></td><td>0.0</td><td>R</td></tr>
</table>

<table>
<tr><th>Object ID</th><th>Attribute ID</th><th>Label</th><th>Description</th><th>Default value</th><th>Handling *1</th></tr>
<tr><td>8. SENCOM Interface block (continued)</td><td>96</td><td>Input 2 Impedance</td><td>Indicates impedance value of the Input 2.
This means the electrical resistance of the reference electrode liquid junction, and used to determine smudge of the reference electrode.
<table><tr><th>Input 2 Impedance</th><th>Status</th></tr><tr><td>0 kΩ</td><td>Input 2 Impedance Too Low</td></tr><tr><td>>= 2000 kΩ</td><td>Input 2 Impedance Too High</td></tr></table></td><td>0.0</td><td>R</td></tr>
<tr><td></td><td>137</td><td>Stable Time</td><td>Indicates the time until the reliable data is available. The unit is second.</td><td>0</td><td>R</td></tr>
<tr><td>20. AI1 block
21. AI2 block
22. AI3 block
23. AI4 block</td><td>1</td><td>Process Value</td><td>AI1, AI2, AI3, and AI4 are output object.
1. Value: output value of the object.
2. Status: indicates the status of the object's output value.</td><td>1. ---
2. ---</td><td>R</td></tr>
<tr><td></td><td>2</td><td>Block Mode</td><td>Select the block's operation status. O/S and Auto can be selected.
1. Target: Specify object mode of the object.
2. Actual: Indicates current mode of the object.
3. Permitted: Indicates the mode selected by Target of the object.
4. Normal: Indicate normal status mode of the object.</td><td>1.Auto
2. Auto
3. Auto
4. Auto</td><td>W(P)</td></tr>
<tr><td></td><td>3</td><td>Concentrator OID</td><td>Indicates the Concentrator object value that corresponds to the data update of the Process Value.</td><td>---</td><td>R</td></tr>
<tr><td></td><td>4</td><td>Scale</td><td>Allows specifying the upper or lower limit for the PV scaling, unit code, etc.
1. EU at 100%: Indicate the upper limit of the PV value
2. EU at 0%: Indicate the lower limit of the PV value
3. Units Index: Indicate the setting unit used for the PV value
4. Decimal: Indicate the digit number below the decimal point displayed in the integral indicator</td><td>1. 100
2. 0
3. %
4. 2</td><td>W(P)</td></tr>
<tr><td></td><td>102</td><td>Tag Description</td><td>A universal parameter to store the comment that describes the tag.</td><td>AI1: AI1
AI2: AI2
AI3: AI3
AI4: AI4</td><td>W(P)</td></tr>
<tr><td></td><td>103</td><td>Simulate Switch</td><td>A simulation function switch for the object.
1: Disable (default)
2: Enable</td><td>Disable</td><td>W(P)</td></tr>
<tr><td></td><td>104</td><td>Simulate Value</td><td>When Simulate Switch is set to Enable, this value is used as the input value for the object. The input value can be changed.</td><td>0</td><td>W(P)</td></tr>
<tr><td></td><td>106</td><td>PV Energy Left Enable</td><td>Allows assign the Energy Left to AI1.PV.Value when Sensor Type in TRANSDUCER block is set to "Not Used".
0: Disable (default)
1: Enable</td><td>0</td><td>W(P)</td></tr>
</table>

*1: R: Read only, W: Read and Write, (P): Target of the write protection
*2: NAMUR NE 107 "Self-Monitoring and Diagnosis of Field Devices"

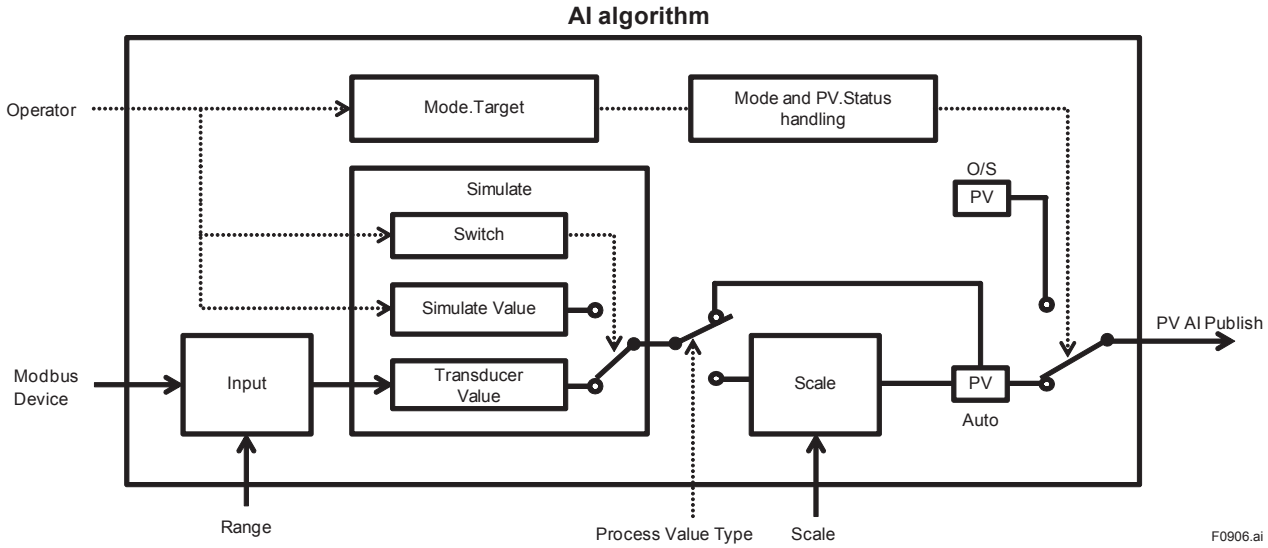


Figure 9.2 Example schema of analog input object

Table 9.5 Diagnostic Status Detail

Bit	Diagnostic Status Detail	Description	Diagnostic status assignment bit	NAMUR NE107 Category *
Diagnostic Status Detail.1				
31	ADAPTER FAIL	FN310 failure	Bit27	F
30	ANTENNA FAIL	FN110 failure	Bit27	F
28	RS485 FAIL	Communication failure between FN110 and FN310	Bit27	F
27	SENSOR FAIL	Disconnection or communication error, between the Modbus device and FN310	Bit26	F
15	DEVICE CONNECTION ERR	Connection error between the Modbus device and FN310	Bit25	C
9	LOWBAT_ALM	Low remaining battery voltage	Bit19	M
8	CRITICAL LOWBAT	Low remaining battery voltage	Bit20	M
7	ADAPTER TEMP HI	FN310 temperature is above +85°C	Bit22	O
6	ADAPTER TEMP LO	FN310 temperature is below -40°C	Bit22	O
5	ANTENNA TEMP HI	FN110 temperature is above +85°C	Bit22	O
4	ANTENNA TEMP LO	FN310 temperature is below -40°C	Bit22	O
Diagnostic Status Detail.2				
31	AI1 OUT OF SERVICE	AI1 O/S Mode	Bit24	C
30	AI2 OUT OF SERVICE	AI2 O/S Mode	Bit24	C
29	AI3 OUT OF SERVICE	AI3 O/S Mode	Bit24	C
28	AI4 OUT OF SERVICE	AI4 O/S Mode	Bit24	C
15	AI1 SIMULATION ACTIVE	AI1 Simulate Mode	Bit17	C
14	AI2 SIMULATION ACTIVE	AI2 Simulate Mode	Bit17	C
13	AI3 SIMULATION ACTIVE	AI3 Simulate Mode	Bit17	C
12	AI4 SIMULATION ACTIVE	AI4 Simulate Mode	Bit17	C
Diagnostic Status Detail.3				
31	DEVICE IMPEDANCE1 TOO HIGH	Input1 impedance value of SENCOM is high	Bit5	M
30	DEVICE IMPEDANCE1 TOO LOW	Input1 impedance value of SENCOM is low	Bit5	M
29	DEVICE IMPEDANCE2 TOO HIGH	Input2 impedance value of SENCOM is high	Bit5	M
28	DEVICE IMPEDANCE2 TOO LOW	Input2 impedance value of SENCOM is low	Bit5	M

*: NAMUR NE 107 “Self-Monitoring and Diagnosis of Field Devices”

10. General Specifications

Please refer to GS 01W03D01-01EN for the latest information.

10.1 Standard Specifications

☐ POWER SUPPLY SPECIFICATIONS

Battery:
Dedicated battery pack.
Rated voltage: 7.2 V
Rated capacity: 19 Ah

Battery Pack:
2x primary lithium-thionyl chloride batteries
With battery case (batteries sold separately)

☐ PERFORMANCE SPECIFICATIONS

Update Period:
8 to 3600 s selectable

Battery Characteristics:
The typical battery life is 8 years under the flowing conditions*1:
• Ambient temperature: 23 ±2°C
• Device role: IO mode
• Update period: 10 minutes
• LCD display: off
*1: Environmental condition such as vibration and the type of connected Modbus device may affect the battery life.

☐ FUNCTIONAL SPECIFICATIONS

Input:
Communication specifications between this product and Modbus devices are below.
Communication Mode: Half-duplex communication (RS-485 compliant)
Protocol: Modbus RTU
Communication Speed: 9600 bps
Number of Modbus devices: 1 device
Cable: Max 20 m (AWG14 to 22 with shield)

Connection Devices:
Connecting a SENCOM (FU20F-NPT) enables to acquire PH, ORP, rH and temperature. To perform the calibration of SENCOM (FU20F-NPT), use SPS24 SENCOM PC Software.

Output:
Communication specifications between this product and FN110 are below.
Communication Mode:
Half-duplex communication (RS485 compliant)
Communication Speed: 9600 bps
Connector: 5-pin round connector dedicated
Cable: Max 20 m (dedicated cable)

Power Supply:
Power supply to the FN110
Supply voltage: 3.5 V
Supply current: 50 mA
Power supply to the Modbus device
Supply voltage: 3.5 V
Supply current: 10 mA

Integral Indicator (LCD display):
5-digit numerical and status display. Display contents and display on/off can be controlled with a magnet (not included).
The indicator displays the following information: Wireless communication status, device status, write protection, sensor data and alarm message

Diagnosis Functions:
Power failures, wired communication failures, firmware internal errors, memory errors, battery alarm, abnormal temperature

Software Download Function:
Software download function permits to update wireless field device software via ISA100 Wireless communication.

☐ INSTALLATION ENVIRONMENT

Ambient Temperature Limits:
Operating: -40 to 85°C (attitude up to 3000 m)
-30 to 80°C (LCD visible range)
Storage: -40 to 85°C

Ambient Humidity Limits:
Operating: 0 to 100%RH (non-condensation)
Storage: 0 to 100%RH (non-condensation)

Ambient Temperature Gradient:
Operating: ±10°C/h or less
Storage: ±20°C/h or less

Vibration Resistance:
0.21 mm P-P (10 - 60 Hz), 3 G (60 - 2 kHz)

Shock Resistance:
50 G 11 ms

☐ REGULATORY COMPLIANCE STATEMENTS

This product satisfies the following standards.

* Please confirm that an installation region fulfills an applicable standard. If additional regulatory information and approvals are required, contact a Yokogawa representative.

CE Conformity: CE

EMC: EN61326-1 Class A Table 2 (For use in industrial locations), EN55011 Class A
Safety: EN61010-1 (Indoor/Outdoor use)

Degrees of Protection:

IP66
IP66 rating applies when the connector is properly tightened.

Explosion-Proof Types

TIIS, FM (United States or Canada), ATEX, IECEx (approvals under pending)

☐ PHYSICAL SPECIFICATIONS

Connections:

Refer to “MODEL AND SUFFIX CODES”.

Housing Material:

Plastic (Polycarbonate)

Weight:

500 g (without mounting bracket, clamp, and battery)

Mounting:

Refer to “MODEL AND SUFFIX CODES”.

10.2 Model and Suffix Codes

Model	Suffix Code		Descriptions
FN310	.....		Field Wireless Multi-Protocol Module
General Specification	Inter module communication	**-A1**.....	Digital communication for FN series
	Protocol	**-J** ..... **-M**	Digital communication (HART 7 *1) Digital communication (RS485 Modbus Protocol)
	Housing Material	**0**	Plastic (Polycarbonate)
	Electrical connection	**0**	Horizontal connection: blind plug, Vertical connection: G 1/2 female *2
		1	Horizontal connection: blind plug, Vertical connection: 1/2 NPT female *2
		2	Horizontal connection: blind plug, Vertical connection: M20 female *2
		3	Horizontal connection: G 1/2 male with clamp, Vertical connection: blind plug *3 *4
		4	Horizontal connection: 1/2 NPT male with clamp, Vertical connection: blind plug *3 *4
		5	Horizontal connection: M20 male with clamp, Vertical connection: blind plug *3 *4
		6	Horizontal connection: blind plug, Vertical connection: blind plug *5
	---	**A**.....	Always A
	Integral indicator	**-D**.....	Digital indicator
	Mounting bracket	**J**	316 SST 2-inch pipe mounting (for horizontal piping)
		K.....	316 SST 2-inch pipe mounting (for vertical piping)
		N.....	None
	---	**A**.....	Always A
	---	**A**.....	Always A
	---	**-A**.....	Always A
	---	**A**.....	Always A
Option codes			/☐ Optional specifications

*1: The HART protocol is backward-compatible with previous versions.
*2: Cable gland is not included. Prepare the cable gland with a flat gasket.
*3: Select when directly attached to the electrical connection port of HART devices.(Protocol code J only)
*4: Make sure before use that the vibration characteristics and the strength of the connection port of the HART device are fulfilled.(Protocol code J only)
*5: Select when intended to use as a routing device.

10.3 Optional Specification (For Explosion Protected Types)

Item		Description	Code
Factory Mutual (FM)	United States	Intrinsically Safe	–
	Canada	Intrinsically Safe	–
ATEX		Intrinsically Safe	–
IECEx		Intrinsically Safe	–

10.4 Optional Specification (For Connection Device Type)

Item	Description	Code
Connection device type*	SENCOM (FU20F-NPT)	**DT2**

*: When protocol code M is selected, specify the connection device.

10.5 Optional Specifications

Item	Description	Code
Protection cap*	Metal waterproof cap	**CP**
Wired tag plate	316 SST tag plate wired onto module	**N4**

*: When protection cap is not specified, dust-cap is attached.

10.6 Optional Accessories

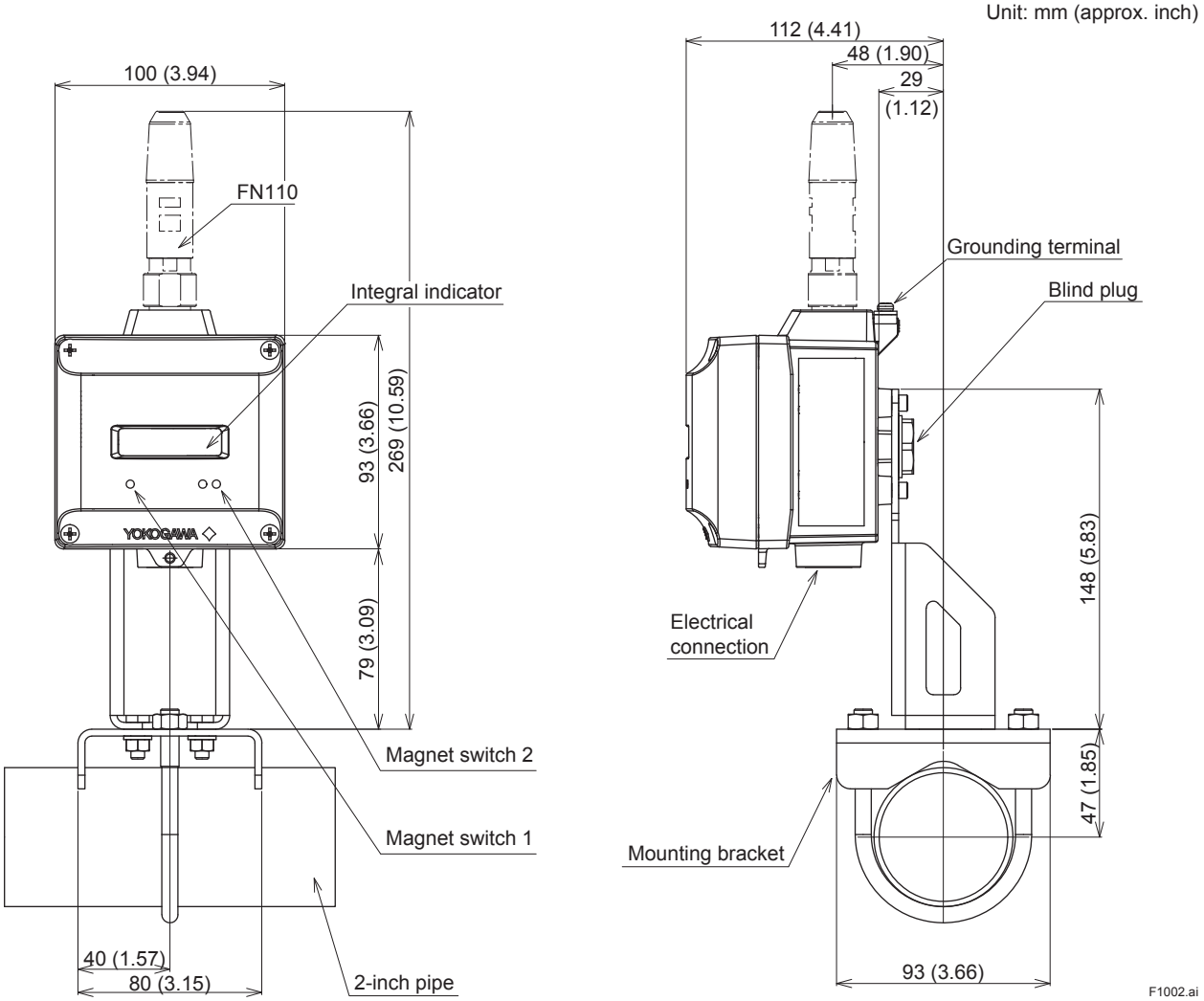
Item	Parts Number	Description
Battery pack assembly	F9090FD	Battery case, Lithium-thionyl chloride batteries*1 2 pieces
Batteries	F9915NR	Lithium-thionyl chloride batteries*1, 2pieces
Battery case*2	F9090GD	Battery case only
Magnet	F9840PA	For magnet switch operation

*1: Tadiran TL-5930/S
*2: Alternatively, Tadiran SL-2780/S, TL-5930/S or VITZROCELL SB-D02 batteries can be purchased from your local distributor.

10.7 Dimensions

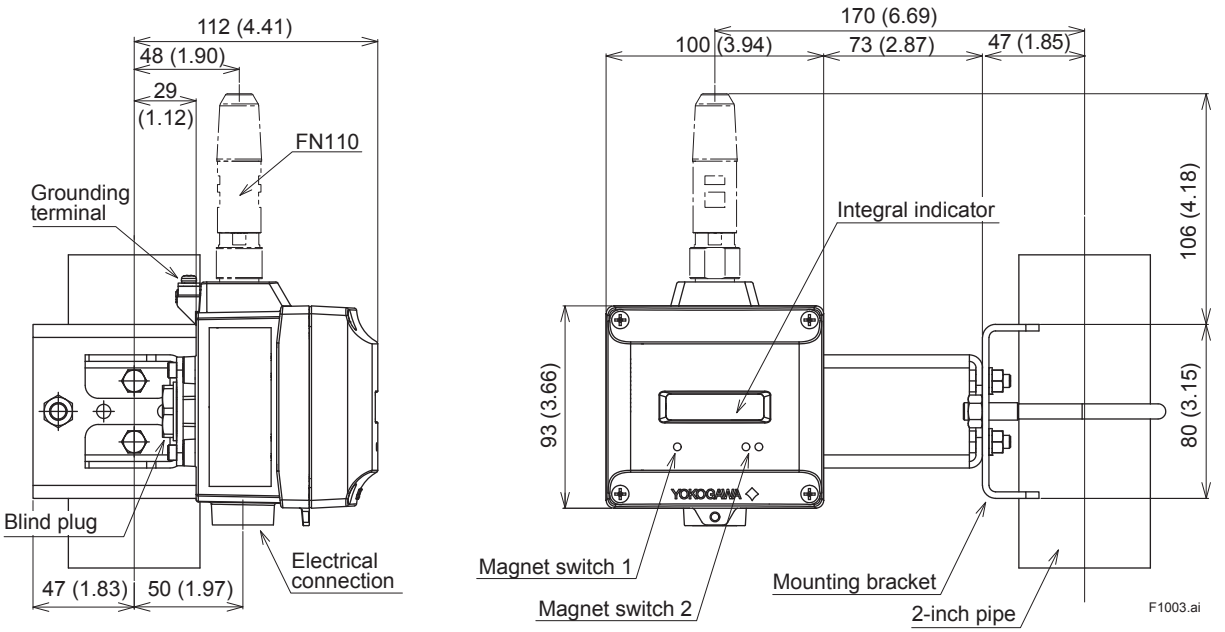
☐ 2-inch pipe mounting (for horizontal piping)

Unit: mm (approx. inch)



☐ 2-inch pipe mounting (for vertical piping)

Unit: mm (approx. inch)



10.8 LCD Display Character List

A	B	C	D	E	F	G	H

I	J	K	L	M	N	O	P

Q	R	S	T	U	V	W	X

Y	Z	1	2	3	4	5	6

7	8	9	0	. (Period)	- (Minus)

F1012.ai

Revision Information

Title : FN310 Field Wireless Multi-Protocol Module (RS485 Modbus Protocol)
Manual No. : IM 01W03D02-01EN

Edition	Date	Page	Revised item
1st	Dec. 2014	—	New Publication